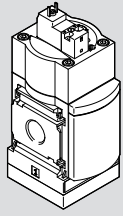


MS6(N)-SV-...-C

Soft start/quick exhaust valve



FESTO

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Operating instructions

8163997
2022-06f
[8163999]



Translation of the original instructions

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1 About this document

This document describes the use of the soft start/quick exhaust valve. The document contains additional information for use of the product in safety-related systems (safety handbook in accordance with IEC 61508).

1.1 Target group

The document is targeted towards individuals who mount and operate the product. It is additionally targeted towards individuals who are entrusted with the planning and application of the product in a safety-oriented system.

1.2 Applicable documents

– Assembly instructions for cover MS6/9-SV-C-MK/MH as tamper protection

All available documents for the product → www.festo.com/sp.

1.3 Specified standards

Version	
EN 60204-1:2016-10	EN ISO 13849-2:2012-10
EN ISO 4414:2010-11	EN ISO 14118:2018-02
EN ISO 13849-1:2015-12	

Tab. 1: Standards specified in the document

2 Safety

2.1 Safety instructions

- Only use the product in its original condition without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Observe the identifications on the product.
- Take into account the ambient conditions at the location of use.
- Before working on the product, switch off the power supply and secure it against being switched on again.
- Observe the tightening torques. Unless otherwise specified, the tolerance is ± 20%.
- Only use compressed air as an operating medium in accordance with the specification → 12 Technical data.

2.2 Intended use

The product is intended for mounting in machines or automation systems and is only to be used as follows:

- in an industrial environment
- in its original condition, without unauthorised modifications
- in safety-related systems only with cover MS6-SV-C-MK as tamper protection
- in perfect technical condition

2.3 Foreseeable misuse

Foreseeable misuse includes:

- outdoor operation
- Bypassing of safety functions
- use in reversible operation with reversal of supply air and exhaust air
- use in "Low Demand Mode" according to EN 61511
- vacuum operation

2.4 Training of qualified personnel

Work on the product may only be carried out by qualified personnel who can evaluate the work and detect dangers. The qualified personnel have skills and experience in dealing with electropneumatic (open-loop) control technology.

3 Additional information

- Contact the regional Festo contact if you have technical problems → www.festo.com.
- Accessories → www.festo.com/catalogue.

Designation	Type
Silencer	U-3/4-B
Cover as protection against tampering, to cover adjustment and control elements	MS6-SV-C-MK

Tab. 2: Accessories

4 Product overview

4.1 Product design

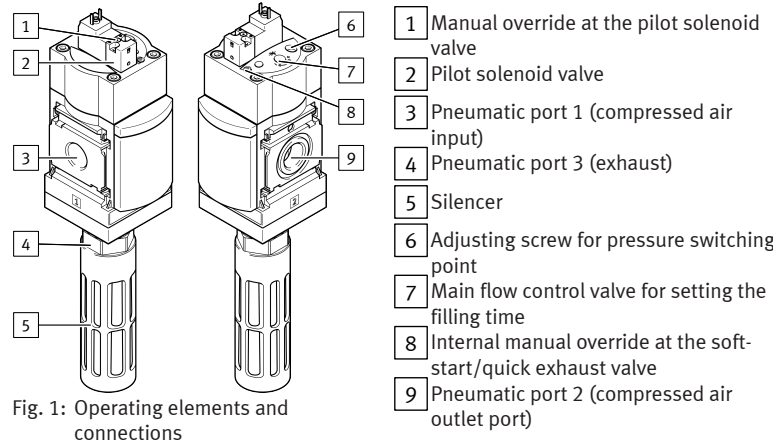


Fig. 1: Operating elements and connections

4.2 Product variants

The following table lists selected product characteristics and codes that are necessary for understanding the instruction manual. Complete type code → www.festo.com/catalogue.

Feature	Code	Description
Series	MS	Standard service unit
Size	6	Grid dimension 62 mm
Thread type	–	Pipe thread ISO 228
	N	NPT
Function	-SV	Soft-start/quick exhaust valve
Port size	-1/2	Thread G 1/2
	-AGB	Sub-base G 1/4
	-AGC	Sub-base G 3/8
	-AGD	Sub-base G 1/2
	-AGE	Sub-base G 3/4
	-AQN	Sub-base NPT 1/4
	-AQP	Sub-base NPT 3/8
	-AQR	Sub-base NPT 1/2
	-AQS	Sub-base NPT 3/4
Performance Level	-C	in accordance with EN ISO 13849-1
Supply voltage	-10V24	24 V DC (plug pattern in accordance with EN 175301-803, type C), 10 bar
	-10V24P -10V24F	24 V DC (M12 in accordance with IEC 61076-2-101), 10 bar
	-10V24C	24 V DC (plug pattern in accordance with EN 175301-803, type C), 10 bar, without manual override
	-10V24D -10V24E	24 V DC (M12 in accordance with IEC 61076-2-101), 10 bar, without manual override
	-V24	24 V DC (plug pattern in accordance with EN 175301-803, type C)
	-V24P	24 V DC (M12 in accordance with IEC 61076-2-101 via plug socket adapter)
	-V110	110 V AC (plug pattern in accordance with EN 175301-803, type C)
-V230	230 V AC (plug pattern in accordance with EN 175301-803, type C)	
Options	-S	Silencer
Cover for tamper protection	-MK	Cover for internal manual override at the soft-start/quick exhaust valve, main flow control valve, adjusting screw for pressure switching point and manual override at the pilot solenoid valve

Tab. 3: Product variants (selection)

4.3 Function

The electro-pneumatic soft start/quick exhaust valve MS6(N)-SV-...-C permits safe venting and building up of pressure in pneumatic piping systems and terminals in industry.

Circuit symbols

MS6(N)-SV...-C-10V24 MS6(N)-SV...-C-10V24F/P MS6(N)-SV...-C-V24 MS6(N)-SV...-C-V24P MS6(N)-SV...-C-V110 MS6(N)-SV...-C-V230	MS6(N)-SV...-C-10V24C MS6(N)-SV...-C-10V24D MS6(N)-SV...-C-10V24E

Tab. 4: Circuit symbols for the functions

4.4 Information on functional safety

4.4.1 Achievable safety rating

The product is suitable for use as an element in a safety-related system in accordance with EN ISO 13849-1 up to category 1, performance level (PL) C.

NOTICE

The suitability for certain applications can only be determined in connection with the assessment of further components of the subsystem. These must achieve the same safety level.

4.4.2 Safety functions

The safety functions are:

- Exhausting in the downstream piping system and terminals
- Prevention of unexpected start-up (pressurisation)

The safety functions are triggered by switching off the power supply at the pilot solenoid valve. As long as the voltage at the pilot solenoid valve remains switched off, the connection between ports 2 and 3 is enabled → 4.3 Function.

This switching position represents the safe state.

4.4.3 Operating conditions

- General information on safe operation → 2 Safety
- Ambient conditions and additional technical specifications → 12 Technical data.

NOTICE

Actuate the product at least once per month to ensure the safety function works properly.

4.4.4 Limitations of use

The duration of use is limited to the maximum operating time T_{10d} or is no more than the mission time T_M → Further information.

4.4.5 Characteristic values

Safety characteristics	MS6(N)-SV...-C
Safety function (Safety Function)	Exhaust Prevention of unexpected start-up (pressurisation)
Note on forced checking procedure ¹⁾	Switching frequency min. 1/month
Performance level (PL) in accordance with EN ISO 13849-1	Up to category 1, PL C ²⁾
Service life value B_{10}	1.2 mill. switching cycles
Service life T_M [a]	20
Maximum operating time T_{10d} [a]	$2 \times B_{10}/n_{op}$ or max. T_M
Diagnostic coverage (Diagnostic Coverage) DC	0
Hardware fault tolerance (Hardware Fault Tolerance) HFT	0
Average probability of dangerous failure per hour (Average probability of dangerous failure per hour) PFH _d	→ Fig. 2
Exhaust time [s]	→ Tab. 9 Exhaust time
CE marking,	Declaration of conformity → www.festo.com/sp

1) Use in "low demand mode" is not permissible.

2) Applies up to the average number of actuations per year = 630,000

Tab. 5: Safety characteristics

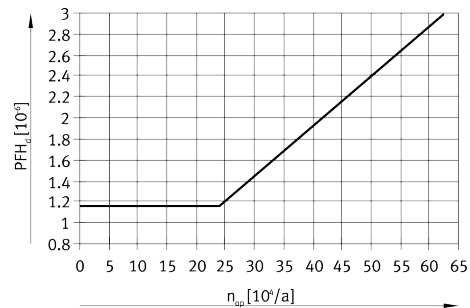


Fig. 2: PFH_d value, dependent on the average number of operations per year (n_{op})

5 Assembly

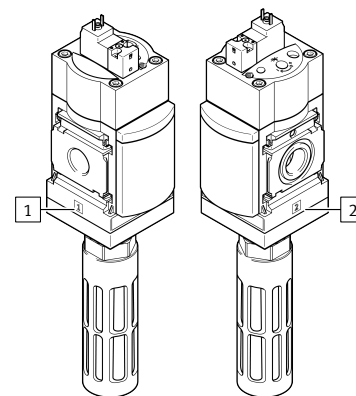
i

Information about mounting the module connector, connecting plate and mounting bracket can be found in the instruction manual enclosed with the relevant accessories.

5.1 Requirements

- Take appropriate measures to remove any particles in the supply lines.

5.2 Preparation



- 1 Digit 1 for port 1
- 2 Digit 2 for port 2

Fig. 3: Flow direction

- Place product as close as possible to the installation site.
- Place the product so that there is enough space for removing and installing the silencer.
- Observe the flow direction from port 1 to port 2. The numbers 1 and 2 on the housing of the MS6(N)-SV...-C serve as orientation.

5.3 Assembly with MS-series service unit components

⚠ WARNING

Loss of the safety function

If devices that impair the exhaust are placed behind the pneumatic connection 2 of the soft start/quick exhaust valve, this can result in loss of the safety function.

- Only place devices that do not impair the exhaust downstream of pneumatic connection 2.

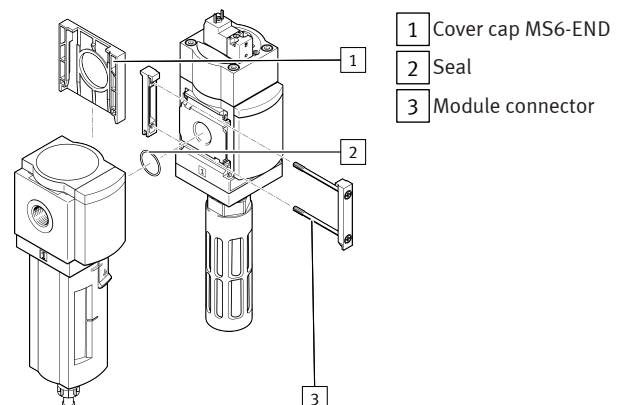


Fig. 4: Assembly

1. Slide the cover cap MS6-END 1, if present, upwards and remove it.
2. Insert a seal 2 between the individual devices (module connector MS6-MV in scope of delivery).
3. Place the module connector 3 in the slots of the separate devices.
4. Fasten the module connector with two screws (in scope of delivery of module connector MS6-MV). Maximum tightening torque 1.2 Nm

6 Installation

6.1 Safety

⚠ WARNING

Risk of injury from compressed air.

- Before carrying out installation and maintenance work, switch off the compressed air supply.

6.2 Pneumatic installation

Port 1 and 2

If using screw connectors:

1. Note the permissible screw-in depth of the connecting thread of 10 mm.
2. Make sure that the compressed air lines are connected correctly.
3. Screw the connectors into the pneumatic ports using a suitable sealing material.

Port 3, thread size G 3/4 or NPT 3/4

i

Exhausting a system using the MS6(N)-SV-...-C results in high noise levels.

- Recommendation: use silencer → www.festo.com/catalogue.

1. Screw the silencer into pneumatic port 3.
2. Make sure exhaust is unhindered: neither the silencer nor port 3 may be blocked.

6.3 Electrical installation

MS6(N)-SV-...-C-10V24.../-V24...:

⚠ WARNING

Risk of injury due to electric shock.

- For the electrical power supply with extra-low voltages, use only PELV circuits that guarantee a reinforced isolation from the mains network.
- Observe IEC 60204-1/EN 60204-1.

MS6(N)-SV-...-C-V110/-V230:

⚠ WARNING

Risk of injury due to electric shock.

- Electrical connections must only be established when the voltage is disconnected and by qualified personnel.
- Use only voltage sources in accordance with IEC 60204-1/EN 60204-1.

- Connect pilot solenoid valve. Accessories → www.festo.com/catalogue.

7 Commissioning

7.1 Pressurising the product and piping system

1. Apply operating pressure p1 at MS6(N)-SV-...-C.
2. Switch on supply voltage.

The outlet pressure p2 is built up slowly. The filling time "t" is set through the main flow control valve attached to the cover → Fig. 1. The output pressure rises in accordance with the throttle position → Fig. 6. If the pre-set pressure switching point (PSP) is reached, the main seat of the valve opens → Fig. 7.

↳ The downstream piping system is pressurised.

i

If the cover is not mounted as tamper protection, the pressurisation process is started with the soft-start function by actuation of one of the manual overrides (→ Fig. 1).

- Reset manual override → 7.3 Resetting the internal manual override.

7.2 Cover for tamper protection

Use:

- In a safety-related system, the setting and control elements must be fitted with a cover for tamper protection → 3 Additional information.
- If the cover is mounted as tamper protection, the manual overrides cannot be actuated.
- In a non-safety-related system, use of the cover is optional.

7.3 Resetting the internal manual override

A reset will be required if the internal manual override at the soft-start/quick exhaust valve [3] was previously actuated without the cover as tamper protection being mounted. Reset can be performed through one of the following measures.

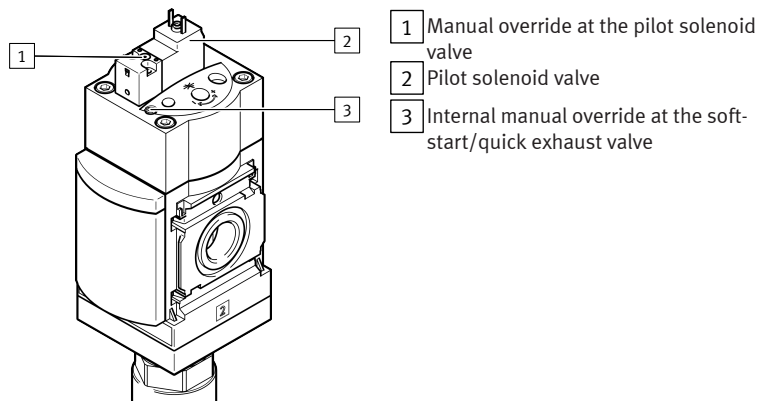


Fig. 5: Reset of the internal manual override

- Output of an electrical signal to pilot solenoid valve [2].
- or
- Actuation of the manual override at the pilot solenoid valve [1].

NOTICE

- MS6(N)-SV-...-C-10V24E:

If the internal manual override is activated, it can only be reset through an electric signal to the pilot control solenoid valve, as the pilot control solenoid valve has no manual override.

8 Operating

If the voltage drops, for example because the power supply is switched off, the product exhausts the downstream piping system → 4.3 Function.

After actuation of the internal manual override:

→ 7.3 Resetting the internal manual override

9 Maintenance

9.1 Maintenance work

A dirty silencer can extend the time needed for exhausting the system and thus restrict the safety function.

- Check the silencer regularly and replace if necessary.

9.2 Cleaning

1. Switch off energy sources:
 - Operating voltage
 - Compressed air
2. If necessary, clean the product on the outside. Soap suds (max. +50 °C), petroleum ether and all non-abrasive cleaning agents may be used.

10 Malfunctions

10.1 Fault clearance

Malfunction	Cause	Remedy
Valve switches abruptly.	Pressure switching point is too low.	– Correct settings.
	Main flow control valve (FCV) is opened too far.	– Correct settings.
Valve does not switch.	Pressure switching point is too high.	– Correct settings.
	Main flow control valve (FCV) is not opened far enough.	– Correct settings.
	Leakage in connected system too high. The switching pressure is not reached.	– Reduce leakage in system.

Tab. 6: Fault clearance

Repairs to the product are not permissible.

- In the event of malfunctions or failure: replace the product and let Festo know about the failure.
- Return defective product to Festo.

11 Dismounting

⚠ WARNING

Risk of injury from compressed air.

- Before dismantling work, switch off the compressed air supply.

1. Switch off energy sources:
 - Operating voltage
 - Compressed air
2. Disconnect the relevant connections of the MS6(N)-SV-...-C.

12 Technical data

12.1 General data

	MS6-SV-...-C	MS6N-SV-...-C
Certificates, declaration of conformity	→ www.festo.com/sp	
Pneumatic port 1	Port sizes → 4.2 Product variants	

	MS6-SV-...-C	MS6N-SV-...-C
Pneumatic port 2	Port sizes → 4.2 Product variants	
Pneumatic port 3	G 3/4	NPT 3/4
Type of mounting	- In-line installation - with accessories	
Mounting position	Any	
Design	Piston slide	
Actuation type	Electric	
Exhaust function	Cannot be throttled	
Type of control	Pilot-controlled	
Valve function	- 3/2-way valve, closed, monostable - Adjustable soft-start function	
Operating medium	Compressed air to ISO 8573-1:2010 [7:4:4] and inert gases	
Information on the operating medium	Lubricated operation possible, in which case lubricated operation will always be required	
Manual override at the soft-start/quick exhaust valve	Detenting/self-reset	
Manual override at the pilot solenoid valve		
-10V24, -10V24F	Non-detenting, actuation from above	
-10V24P	Non-detenting/detenting, actuation from above	
-10V24C/D/E	No manual override	
-V24, -V24P, -V110, -V230	Non-detenting/detenting, actuation from front	
Operating pressure p1		
-10V24, -10V24P/C/D/E/F	[MPa]	0.3 ... 1
	[bar]	3 ... 10
	[psi]	43.5 ... 145
-V24, -V24P, -V110, -V230	[MPa]	0.3 ... 1.8
	[bar]	3 ... 18
	[psi]	43.5 ... 261
Characteristic flow rate values		
Pressure switching point	Adjustable → 12.3 Pressure switching point (PSP)	
Pressurisation flow rate	Adjustable via main flow control valve (FCV) → 12.2 Pressurisation flow rate	
Standard nominal flow rate 1 → 2	[l/min]	5700
Standard nominal flow rate 2 → 3	[l/min]	7600 measured at p = 0.6 MPa (87 psi; 6 bar) with silencer U-3/4-B
Electrical connection		
-10V24, -V24, -10V24C	Plug, 2-pin, in accordance with EN 175301-803, type C	
-V24P, -10V24P/D/E/F	M12x1, 4-pin, in accordance with EN 61076-2-101	
-V110, -V230	Plug, 3-pin, in accordance with EN 175301-803, type C	
Coil characteristics		
-10V24, -10V24P/C/D/E/F	24 V DC, 1.8 W	
-V24, -V24P	24 V DC, 1.5 W	
-V110	110 V AC, 50/60 Hz, pick-up power 3 VA, holding power 2.4 VA	
-V230	230 V AC, 50/60 Hz, pick-up power 3 VA, holding power 2.4 VA	
Permissible voltage fluctuations		
-10V24, -10V24P/C/D/E/F, -V24, -V24P, -V110	[%]	±10
-V230	[%]	-14 ... +10
Operating and environmental conditions		
Ambient temperature	[°C]	0 ... +60 (0 ... +50 with pressure sensor)
Temperature of medium	[°C]	0 ... +60 (0 ... +50 with pressure sensor)
Storage temperature	[°C]	-10 ... +60 (0 ... +50 with pressure sensor)
Shock resistance	Shock test with severity level 2 in accordance with FN 942017-5 and EN 60068-2-27	
Vibration resistance	Transport application test with severity level 2 in accordance with FN 942017-4 and EN 60068-2-6	
Sound pressure level ¹⁾	[dB(A)]	93
Degree of protection	IP65 with plug socket	
Weight		
without silencer	[g]	886
with silencer U-3/4-B	[g]	1006
Materials		
Housing	Die-cast aluminium	
Cover top/bottom	PA	
Piston rod	High-alloy steel	
Seals	NBR	

1) maximum A-weighted impulse sound pressure level at the loudest measuring point during exhaust of the valve with silencer U-3/4-B

Tab. 7: General technical data

Type of severity level (SL)

Vibration load					
Frequency range [Hz]		Acceleration [m/s ²]		Deflection [mm]	
SL1	SL2	SL1	SG2	SL1	SL2
2 ... 8	2 ... 8	–	–	±3.5	±3.5
8 ... 27	8 ... 27	10	10	–	–
27 ... 58	27 ... 60	–	–	±0.15	±0.35
58 ... 160	60 ... 160	20	50	–	–
160 ... 200	160 ... 200	10	10	–	–
Shock load					
Acceleration [m/s ²]		Duration [ms]		Shocks per direction	
SL1	SL2	SL1	SL2	SL1	SL2
±150	±300	11	11	5	5
Continuous shock load					
Acceleration [m/s ²]		Duration [ms]		Shocks per direction	
±150		6		1000	

Tab. 8: Type of severity level (SL)

12.2 Pressurisation flow rate

Flow rate q_n as a function of the number of revolutions n of the main flow control valve (FCV) → Fig. 6.

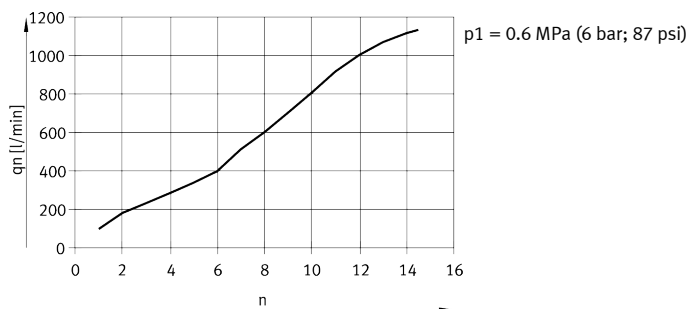


Fig. 6: Flow diagram

12.3 Pressure switching point (PSP)

A slow pressure build-up of outlet pressure p_2 is achieved with the main flow control valve located in the cover. If the outlet pressure p_2 has reached the switch-through pressure, the valve opens and the complete operating pressure p_1 is applied at the output port.

The pressure switching point can be set by turning the adjusting screw for the pressure switching point.

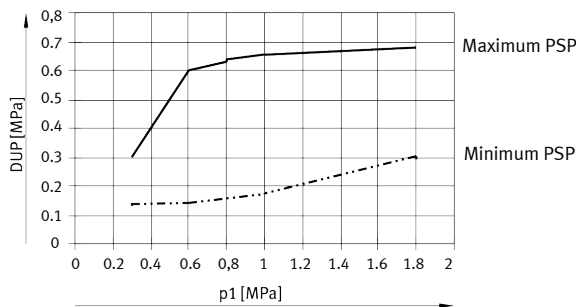


Fig. 7: Pressure switching point

12.4 Exhaust time

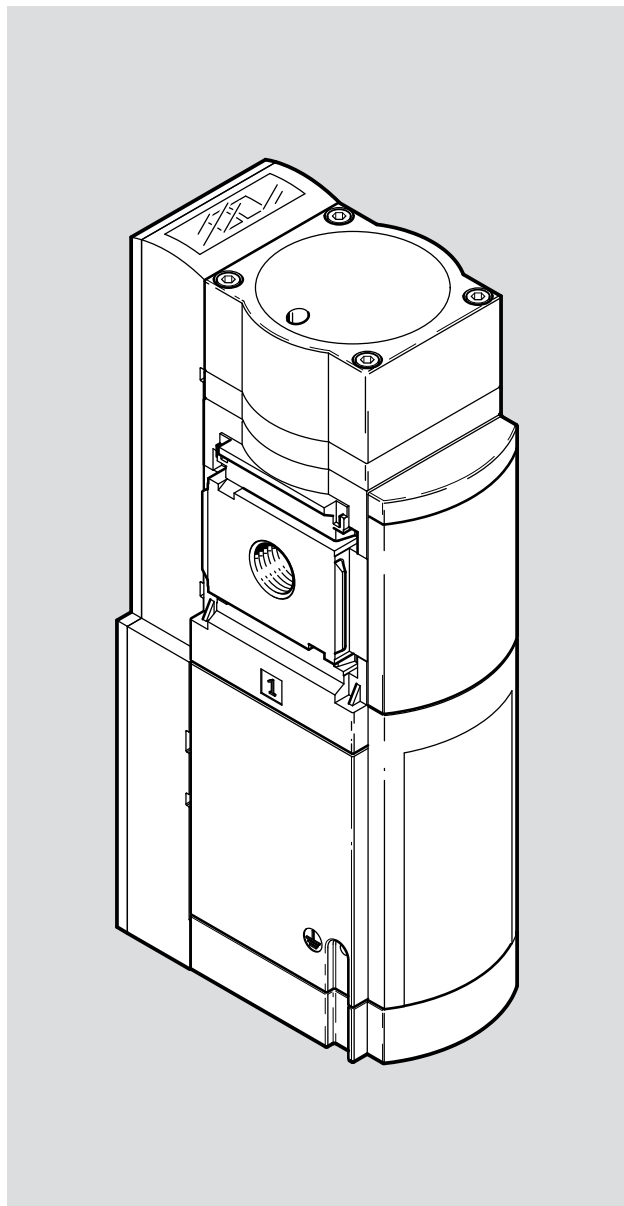
The following table shows the exhaust time in normal operation (N) with silencer U-3/4-B at various volumes and operating pressures.

Normal operation N	Exhaust time [s]								
	Operating pressure	0.3		0.6		1		1.8	
	[MPa]								
	[bar]	3	6	10	18				
	[psi]	43.5	87	145	261				
Exhaust to	[MPa]	0.1	0.05	0.1	0.05	0.1	0.05	0.1	0.05
	[bar]	1	0.5	1	0.5	1	0.5	1	0.5
	[psi]	14.5	0.725	14.5	0.725	14.5	0.725	14.5	0.725
Volume [l]	2	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8
	10	0.6	0.8	0.9	1.1	1.1	1.3	1.4	1.6
	20	0.9	1.3	1.5	1.9	1.9	2.9	3.5	3.0
	40	1.5	2.2	2.6	3.4	3.4	4.3	4.5	5.5

Tab. 9: Exhaust time

MS6(N)-SV-...-E-10V24

Soft start/quick exhaust valve



FESTO

Operating instruction



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[8176554]

Translation of the original instructions

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1 About this document

1.1 Target group

The document is targeted towards individuals who mount and operate the product. It is additionally targeted towards individuals who are entrusted with the planning and application of the product in a safety-oriented system.

1.2 Applicable Documents



All available documents for the product → www.festo.com/sp.

1.3 Product version

This documentation refers to the following version:

- Soft start/quick exhaust valve MS6-SV-...-E-10V24 from Revision 06, see product labelling.

1.4 Specified standards

Version	
EN ISO 12100:2010-11	EN 60068-2-27:2009-05
EN ISO 13849-1:2015-12	EN 61131-2:2007-09
EN ISO 13849-2:2012-10	IEC 60204-1:2016-10
EN 60068-2-6:2008-02	ISO 8573-1:2010-04
EN 61508-1:2010-05	ISO 19973-1:2015-08

Tab. 1: Standards specified in the document

2 Safety

2.1 Safety instructions

- Only use the product in its original condition without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Observe the identifications on the product.
- Take into account the ambient conditions at the location of use.
- Prior to mounting, installation and maintenance work: Switch off power supply and secure it from being switched back on.
- Observe the tightening torques. Unless otherwise specified, the tolerance is $\pm 20\%$.
- The product must be operated only with the specified multi-pin plug sockets NECA-S1G9-P9-MP...
- Non-compliance with the information in this instruction manual can lead to loss of the safety function.

2.2 Intended Use

The product is intended solely for fast and safe venting and for building up pressure gently in pneumatic piping systems and terminals in industry. The product is a safe, redundant mechatronic system designed for implementation of the safety functions:

- Safe venting
- Protection against unexpected pressure build-up (pressurisation).

The product is intended for installation in a machine or automated system and must be used exclusively as follows:

- In an industrial environment
- Within the limits of the product defined by the technical data → 12 Technical Data.
- In its original condition, without unauthorised modifications
- In perfect technical condition
- In standard operation, which includes standstill, set-up and service operation, as well as emergency operation

2.3 Foreseeable Misuse

The following examples of foreseeable misuse are among those not approved as intended use:



- Outdoor use
- Operation without adequate venting options → 5 Assembly
- Use as press safety valve
- Bypass of the safety function
- Use in reversible operation (using supply air instead of exhaust air, and vice versa)
- Vacuum operation
- Use of incorrect or clogged silencers

2.4 Training of qualified personnel

Installation, commissioning, service and disassembly should only be conducted by skilled personnel. The skilled personnel must be familiar with the installation of electrical and pneumatic control systems.

2.5 Product conformity

The product-relevant directives are listed in the declaration of conformity → www.festo.com/sp.

Product conformity	
	in accordance with EU EMC Directive in accordance with EU Machinery Directive in accordance with EU RoHS Directive
	to UK EMC Regulations to UK Supply of Machinery Regulations to UK RoHS Regulations

Tab. 2: Product conformity

3 Additional information

- Contact the regional Festo contact if you have technical problems → www.festo.com.
- Accessories and spare parts → www.festo.com/catalogue.

4 Product overview

4.1 Configuration

The product corresponds to category 4 with a maximum achievable performance level e in accordance with EN ISO 13849-1.

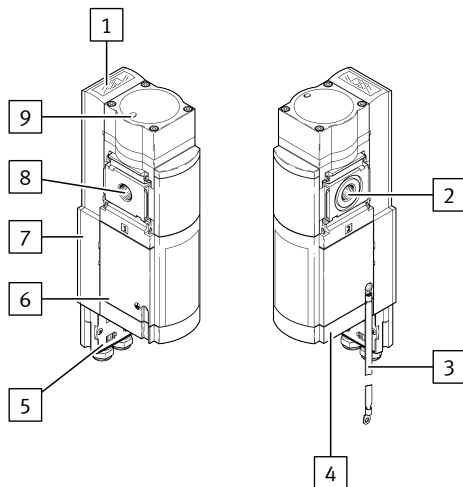


Fig. 1: Product design

- | | |
|---|---|
| 1 LED display (Power LED and Error LED) | 6 valve block |
| 2 pneumatic port 2 (compressed air outlet) | 7 electronic insert |
| 3 pre-assembled earthing strap | 8 pneumatic port 1 (compressed air input) |
| 4 pneumatic port 3 (exhaust) | 9 flow control screw for soft start function |
| 5 multi-pin plug socket NECA (accessories) | |

Feature	Code	Type
Series	M	Modular
Performance class	S	Default
Size	6	Housing width 62 mm
Function	- SV	Soft-start/quick exhaust valve, electric
Port size	- 1/2	G1/2

Feature	Code	Type
Port size	– AGB	G1/4
	– AGC	G3/8
	– AGD	G1/2
	– AGE	G3/4
	– AQN	NPT1/4
	– AQP	NPT3/8
	– AQR	NPT1/2
	– AQS	NPT3/4
Performance Level	– E	In accordance with EN ISO 13849-1, category 4 2-channel with self-monitoring, safety device in accordance with EC Machinery Directive 2006/42/EC
Supply voltage	– 10V24	24 V DC
Options ¹⁾	– SO	Open silencer
Pressure gauge/pressure gauge alternative ¹⁾	– AG	Integrated pressure gauge
	– A4	Adapter for EN pressure gauge 1/4, without pressure gauge
	– AD1	Pressure sensor with display, M8 plug, PNP, 3-pin
	– AD2	Pressure sensor with display, M8 plug, NPN, 3-pin
	– AD3	Pressure sensor with display, plug M12, PNP, 4-pin, analogue output 4 ... 20 mA
	– AD4	Pressure sensor with display, plug M12, NPN, 4-pin, analogue output 4 ... 20 mA
Alternative pressure gauge scaling ¹⁾	– PSI	psi scaling
	– MPA	MPa scaling
	– BAR	bar scaling
Multi-pin plug socket ¹⁾	– MP1	Sub-D, 9-pin, screw terminal, without cable Enable signals static (EN1 = 24 V, EN2 = 24 V)
	– MP3	Sub-D, 9-pin, screw terminal, without cable Enable signals static (EN1 = 0 V, EN2 = 24 V) Detection of shorts across contacts possible
	– MP5	Sub-D, 9-pin, screw terminal, without cable Enable signals static (EN1 = 0V, EN2 = 24V) Galvanic isolation of enable signals from the supply voltage
Type of mounting ¹⁾	– WPB	Mounting bracket for large mounting spacing

Feature	Code	Type
UL certification ¹⁾	– UL1	UL certification for Canada and USA
Alternative flow direction ¹⁾	– Z	Flow direction from right to left

1) Optional

Tab. 3: Product overview

4.2 Function

The product is a safe, redundant mechatronic system in accordance with the requirements of EN ISO 13849-1+2. The safe venting pneumatic safety function is guaranteed even in the event of a fault in the valve, e.g. due to wear or contamination. Through its electrical connection (NECA Sub-D multi-pin plug socket, 9-pin), the product receives secure enable signals (EN1/EN2) from commercially-available electronic or electromechanical safety relay units, which monitor the machine's protective devices (e.g. emergency stop, light curtain, electric door switch on the protective housing, etc.).

Automatic start/monitored start modes of operation

Two modes of operation are possible:

- Automatic start (automatic reset)
The automatic start (automatic reset) mode of operation is preset with a bridge from terminal 5 to terminal 6 in the multi-pin plug socket NECA (delivery status).
- Monitored start (monitored reset)
The monitored start (monitored reset) mode of operation should be seen as a subordinate start from the perspective of the complete system. The enable signal from the safety relay or the controller always has priority.

In both modes of operation, the product can be electrically triggered using either static or dynamic enable signals (EN1/EN2), depending on the NECA multi-pin plug socket.



The impulse generated by the start button must be within a time-frame of 0.1 s and 2 s. If the start button is held down for too long or is locked down, the system identifies a cross circuit and the product is placed in fault mode.



The start signal for S34 must not be generated until 1 s after the enable signals EN1/EN2 are created. If the start signal is generated before or simultaneously with the enable signals, it will not be recognised and must be generated again.

Automatic start (delivery status) and monitored start

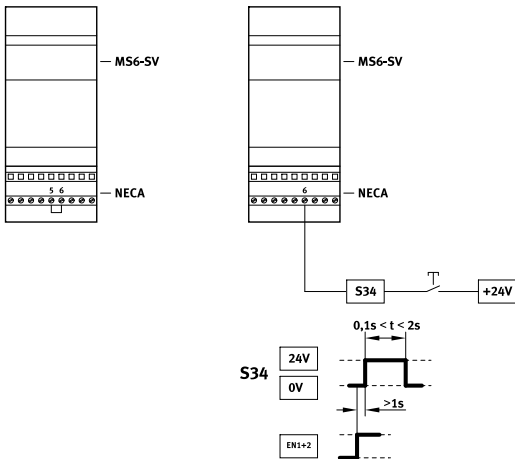


Fig. 2: Operating modes

Operational principle of the multi-pin plug sockets NECA-...-MP1, -MP3 und -MP5

Status of EN1	Status of EN2	Status of valve with NECA-...-MP1	Status of valve with NECA-...-MP3	Status of valve with NECA-...-MP5
0 V	0 V	Unpressurised	Valve switches to fault mode	Valve does not switch to fault mode, but remains in the safe, unpressurised status Note: Detection of shorts across contacts and error detection and evaluation via external controller is required
0 V	24 V	Valve switches to fault mode	Pressurised	Pressurised
24 V	24 V	Pressurised	Valve switches to fault mode	Valve does not switch to fault mode, but remains in the safe, unpressurised status Note: Detection of shorts across contacts and error detection and evaluation via external controller is required
24 V	0 V	Valve switches to fault mode	Unpressurised	Unpressurised

Tab. 4: Operational principle of the multi-pin plug sockets NECA

Identification of signal transitions

If safety outputs with test pulses are used to control the product, the following runtime performance must be observed:

- MS6-SV-E exhaust status
 - Test pulses < 3 ms are ignored
- MS6-SV-E pressurise status
 - Test pulses < 12 ms are ignored

Detection of shorts across contacts of the enable signals

In general, detection of shorts across contacts is required to guarantee performance level e. Depending on the selected plug, either the product itself or the safety relay unit/PLC detects the cross circuit.

NECA-...-MP1	NECA-...-MP3	NECA-...-MP5
by safety relay unit/PLC (clocked signals)	by product	by safety relay unit/PLC (potential difference monitoring)

Tab. 5: Detection of shorts across contacts

Connection examples

MS6-SV-E with multi-pin plug socket NECA-S1G9-P9-MP1

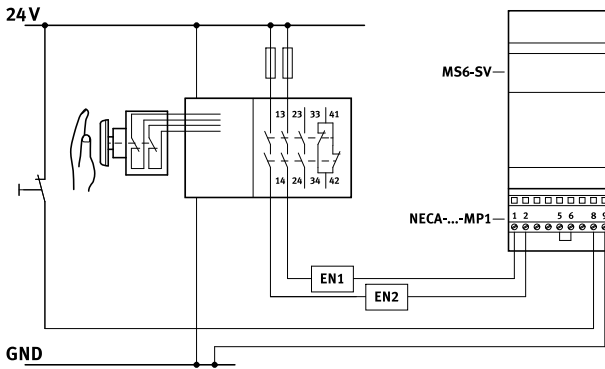


Fig. 3: Connection NECA-...-MP1

The multi-pin plug socket NECA-...-MP1 can be used for static and clocked safety outputs.

- static enable signals (EN1/EN2 = 24 V)

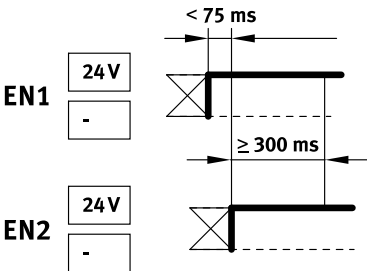


Fig. 4: Static enable signals – signal distance

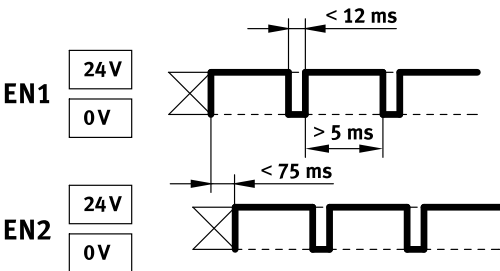


Fig. 5: Enable signals – detection of shorts across contacts

- clocked enable signals (EN1/EN2 = 24 V) for detection of shorts across contacts.

Detection of shorts across contacts by clock signals is always carried out by the safety relay unit/safety PLC.

Switching characteristics diagrams → Fig. 20.

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The clock outputs of different controller manufacturers are not standardised. The usability must be checked in every case. If the clock pulse is outside the described limits, this is recognised by the product as an error and a safe switch-off is carried out.

MS6-SV-E with multi-pin plug socket NECA-S1G9-P9-MP3

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The multi-pin plug socket NECA-S1G9-P9-MP3 is intended for conventional circuitry with electromechanical safety relays. If problems arise in use with bipolar semiconductor outputs, use the multi-pin plug socket NECA-S1G9-P9-MP5.

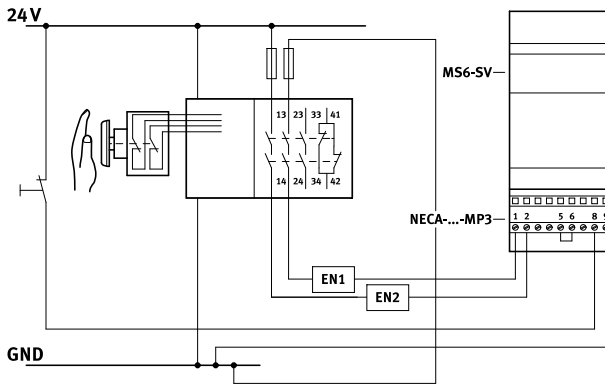


Fig. 6: Connection with NECA-...-MP3

- static enable signals with opposite potentials
- Time delay of the level change of the enable signals is monitored
- Behaviour on detection of a cross circuit:
 - Product in exhausted status: remains in safe status and switches to malfunction
 - Product in pressurised status: switches to safe status and to malfunction

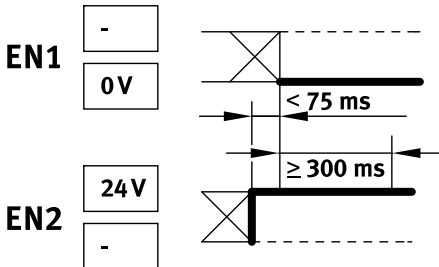


Fig. 7: Static enable signals – signal distance

Switching characteristics diagrams → Fig. 23.

MS6-SV-E with multi-pin plug socket NECA-S1G9-P9-MP5

NOTICE

A cross circuit between the enable signals EN1/EN2 is not detected and does not cause an error response. The system is pressurised only if the enable signals are applied correctly.

- Ensure that detection of shorts across contacts is established and guaranteed by corresponding measures in the peripherals (PLC/safety control) in accordance with the valid safety standards.

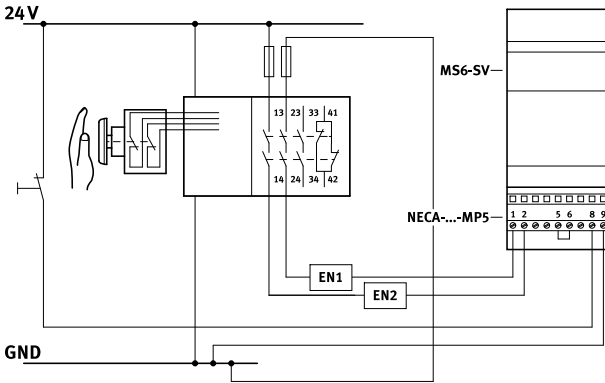


Fig. 8: Connection with NECA...-MP5

- static enable signals with opposite potentials
- Time delay of the level change of the enable signals is not monitored
- Behaviour on detection of a cross circuit (by upstream safety relay unit/PLC):
 - MS6-SV- E in exhausted status: remains in safe status and does not go into malfunction
 - MS6-SV- E in pressurised status: goes into safe status and does not go into malfunction
- Enable signals are galvanically separated from the supply voltage

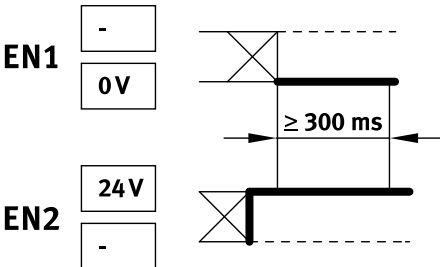


Fig. 9: Static enable signals – signal distance

Switching characteristics diagrams → Fig. 23.

Switching statuses



The time delay t_2 between EN1 and EN2 must be automatically defined. The duration of the delay is not evaluated. The multi-pin plug socket NECA-MP5 does not enable the product to detect shorts across contacts.

Signal contact

The signal contact is a potential-free N/O contact of a semiconductor relay. The contact can be picked up in the feedback circuit of a safety control system through terminals 3 and 4 of the NECA multi-pin plug socket as required.

NOTICE

If the signal contact is operated outside the permitted technical data, this will cause irreparable failure. Compliance with the specification must be ensured through an appropriate protective circuit.

NOTICE

Assignment of these contacts is not required to achieve the safety category.

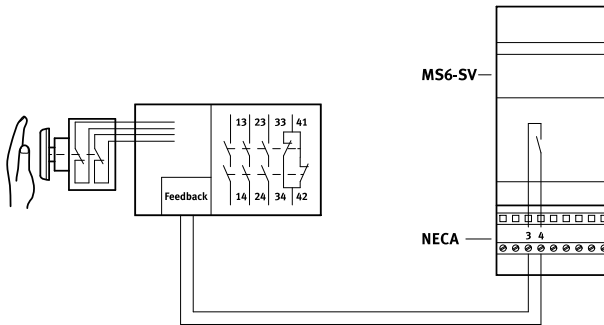


Fig. 10: Feedback signal connection

Switching behaviour diagrams, with multi-pin plug socket NECA-S1G9-P9-MP1 → Fig. 20 and with multi-pin plug socket NECA-S1G9-P9-MP3/MP5 → Fig. 23.

Status of valve	Signal contact
Control for pressurisation by EN1 and EN2	open
Control for exhaust through EN1 and EN2	closed
Malfunction (red LED flashing)	open
Supply voltage is not connected	open

Tab. 6: Switching statuses of the signal contact

Switch-through pressure/filling time

The flow control screw in the cover generates a gradual pressure build-up of outlet pressure p2. The pressure rise can be adjusted by turning the flow control screw. When the outlet pressure p2 reaches about 50% of the operating pressure p1, the valve opens and the maximum flow rate performance is enabled.

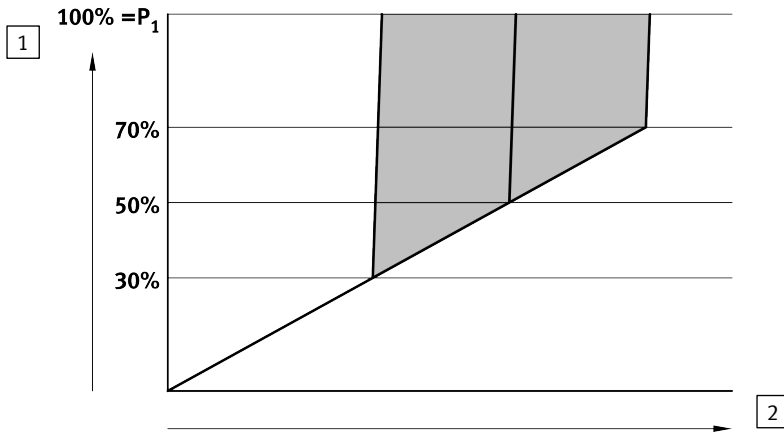


Fig. 11: Switch-through pressure tolerance field

1 Ratio of p_2 to p_1 [%]

2 Time axis

Example:

At an operating pressure of $p_1 = 4$ bar with reference to the approved tolerance of $\pm 20\%$ a switch-through pressure of 1.2 to 2.8 bar is permissible.

4.3 Safety function in accordance with EN ISO 13849

The product is a safe, redundant mechatronic system designed for implementation of the safety functions:

- Safe venting
- Protection against unexpected pressure build-up (pressurisation).

NOTICE

Loss of the safety function

The product must be brought to initial position (exhausted status) at least once a month to guarantee the safety function.

NOTICE

Loss of the safety function

Common cause failures (CCF) cause the failure of the safety function, since in this case both channels in a two-channel system fail simultaneously.

If measures to control the CCFs are not observed, the safety function of the soft-start/quick exhaust valve can be impaired.

- Make sure that the described measures are observed.

NOTICE

Loss of the safety function

Non-compliance with the technical data can lead to loss of the safety function.

The electro-pneumatic soft-start/quick exhaust valve has control technology features which enable performance level e to be reached for the safety functions. This product has been designed and manufactured in accordance with the fundamental and reliable safety principles of EN ISO 13849-2. The following requirements apply to the manager:

- The specifications for mounting and the operating conditions in these operating instructions must be observed.
- For use in higher categories (2 to 4), the requirements of EN ISO 13849, e.g. CCF, must be considered.
- The basic and proven safety principles of EN ISO 13849-2 relating to implementation and operation of the component must be satisfied.
- When using this product in machines or systems subject to specific C standards, the requirements specified in these standards must be observed.
- Before using the product, a risk assessment in accordance with EN ISO 12100 as specified in the EC Machinery Directive 2006/42/EG, Annex I, Paragraph 1 and 1.1.2 is required.
- The user is responsible for coordinating all applicable safety regulations and rules with the competent authority and for compliance with regulations and rules.

Failures due to a common cause (Common Cause Failure – CCF)

The following measures ensure that common cause failures are avoided:

- Compliance with the permissible values for vibration and shock stress
- Compliance with the temperature range
- Compliance with compressed air quality as specified in the technical data, in particular avoiding flash rust particles (such as caused by servicing work) as well as compliance with the residual oil content of max. 0.1 mg/m³ when using ester-containing oils (which may, for example, be contained in the compressor oil)
- Compliance with the maximum operating pressure, if necessary with a pressure-relief valve
- Clogging of the silencer must be avoided.

PFH_D value



The PFH_D value depends on the model of the product and the annual actuation rate (n_{op}).

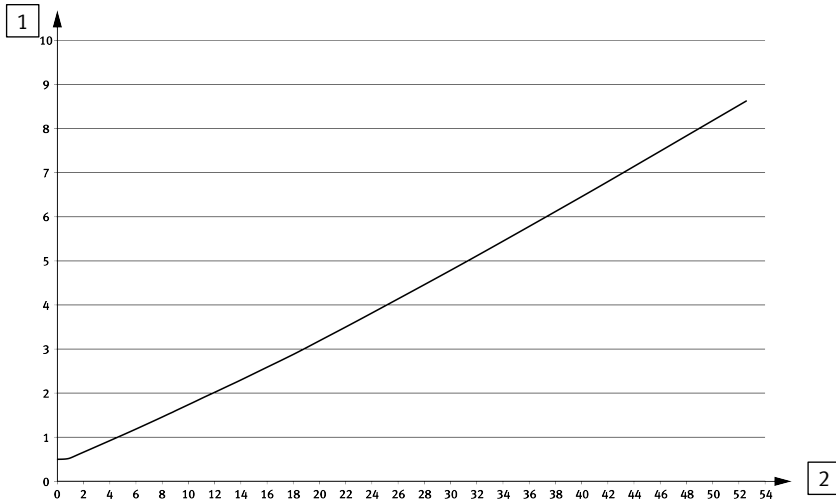


Fig. 12: PFH_D

1 PFH_D [10⁻⁸ h⁻¹]

2 Actuation rate (n_{op}) [10⁴/a]

5 Assembly

5.1 Requirement

- Take appropriate measures to remove any particles in the supply lines.

5.2 Preparation

NOTICE

In order to ensure electromagnetic compatibility in accordance with the EMC Directive, note the following:

- Ensure a wall clearance of 32 mm, e.g. with the MS6-WPB mounting bracket.
- Do not lay cables between the wall and the product.

NOTICE

Loss of the safety function

Failure to comply with the minimum distance of 15 mm between the silencer and base can result in the loss of the safety function.

- observe minimum distance of 15 mm below the silencer.

The free space ensures the exhaust can escape.

- Place product as close as possible to the installation site.
- The product can be mounted in any position.

Assembly

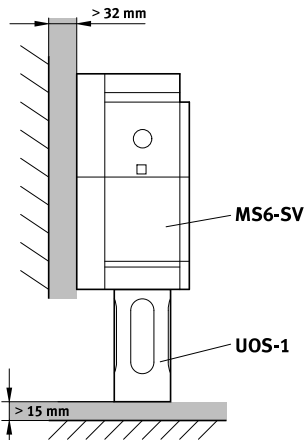


Fig. 13: Mounting

- Observe the flow direction 1 to 2. The numerals **1** on the product housing serve as orientation.

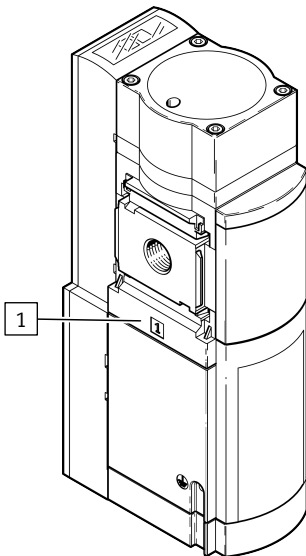


Fig. 14: Flow direction

5.3 Assembly with MS-series service unit components

⚠ WARNING

Loss of the safety function

If devices that impair the exhaust are placed behind the pneumatic connection 2 of the soft start/quick exhaust valve, this can result in loss of the safety function.

- Only place devices that do not impair the exhaust downstream of pneumatic connection 2.

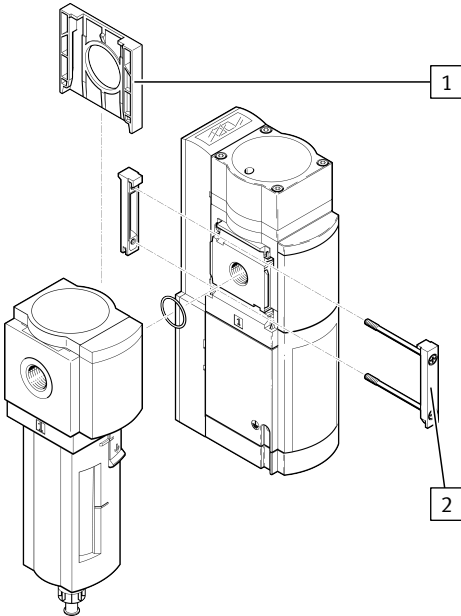


Fig. 15: Assembly

1 Cover cap MS6-END

2 Module connector

1. Slide the cover cap MS6-END **1** upwards and remove it.
2. Insert a seal **2** between the individual devices (module connector MS6-MV in scope of delivery).
3. Place module connector **2** in the slots of the individual devices.
4. Fasten the module connector with two screws (product scope of delivery). Tightening torque: maximum 1.2 Nm.

6 Installation

6.1 Pneumatic installation

Port 1 and 2

If using screw connectors:

- Note the screw-in depth of the connector thread: 10 mm.
- Make sure that the compressed air lines are connected correctly.
- Screw the connectors into the pneumatic connections using a suitable sealing material.

Port 3

NOTICE

Failure of the safety function

Clogging of the cushioning body of an unsuitable silencer may result in reduced bleeding (back pressure). This may result in failure of the safety function.

- Use the silencer UOS-... intended for the device exclusively.
-
- Use only suitable silencers → www.festo.com/catalogue.
 - Screw the silencer into pneumatic port 3.
 - Make sure exhaust has no obstacles: do not block silencer or port 3.

6.2 Electrical installation

⚠ WARNING

Risk of injury due to electric shock.

- For the electric power supply, use only PELV circuits that ensure a reliable electric disconnection from the mains network.
 - Observe IEC 60204-1/EN 60204-1.
-

Connecting earthing strap

- Connect the pre-assembled earth strap to the earth potential with low impedance (short cable with large cross-section).

This prevents malfunctions due to electromagnetic interference and ensures electromagnetic compatibility in accordance with the EMC Directives.

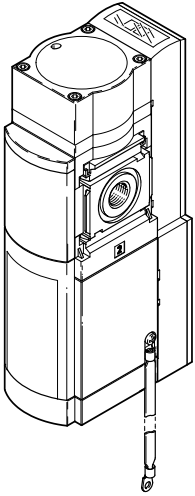


Fig. 16: Earth cable connection

Connecting multi-pin plug socket NECA



The product may only be used with the approved NECA multi-pin plug sockets NECA-.... Information on terminal connections can be found in the assembly instructions enclosed with the multi-pin plug socket.



When mounting the multi-pin plug sockets NECA-... with enclosed seal, note the correct position of the plug with reference to the valve. The display window of the multi-pin plug socket NECA-... must point forward.

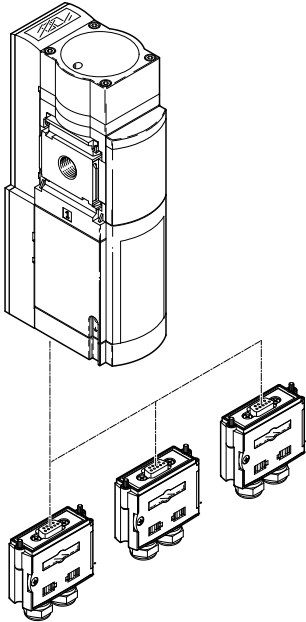


Fig. 17: Electrical connection

1. Connect multi-pin plug socket NECA-... in the correct orientation. The window points to the silencer.
2. Make sure that the screws are fastened tightly in order to guarantee the degree of protection IP65. The maximum tightening torque is 0.4 ± 0.1 Nm.

Inputs and outputs

Terminal in multi-pin plug socket NECA-...	I/O	I/O allocation	
1	EN1	Enable signal 1 (static or dynamic)	Input 0 V/24 V (EN 61131-2 type 2)
2	EN2	Enable signal 2 (static or dynamic)	Input 0 V/24 V (EN 61131-2 type 2)
3	13	Signal contact, NO	Potential-free contact (semiconductor relay), maximum 120 mA, maximum 60 V DC
4	14		
5	A5	Contact for automatic start operating mode	–

Terminal in multi-pin plug socket NECA-...	I/O	I/O allocation	
6	S34	Contact for automatic start or monitored start operating mode	Input 0 V/24 V (EN 61131-2 type 2)
7	-	-	
8	+L1	Operating voltage	+24 V DC \pm 10%
9	M	GND	

Tab. 7: Terminal assignment

7 Commissioning

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For easier commissioning, we recommend installation of a reset button (normally closed) in the power supply circuit. This simplifies a reset in case of error.

The commissioning description is graphically supported with the following diagrams:

- with multi-pin plug socket NECA-S1G9-P9-MP1 → Fig. 20.
- with multi-pin plug socket NECA-S1G9-P9-MP3/MP5 → Fig. 23.

The diagrams show the switching characteristics of the inputs and outputs in normal operation (if the automatic start mode of operation has been set). The operator's actions are marked in the diagram by an arrow.

1. Apply operating pressure p1.
2. Switch on the supply voltage. The product runs a self-test for errors.
 - Power LED (green)
 - lights during self-test for around 6 s
 - Flashes green after successful self-test
 - Error LED (red)
 - lights during self-test for around 6 s
 - goes out after successful self-test

There is a brief ejection of compressed air at outlets 2 and 3 during the self-test.

↳ The product is now ready for operation and can be pressurised.



The valve is tested pneumatically in a self-test once an hour for as long as the product remains in this status. Operating pressure p1 must be applied; otherwise, the valve switches to malfunction.

3. Apply Enable signals EN1/EN2. In monitored start operating mode a start signal is also required at S34 .
 - Power LED (green) lights.
 - The outlet pressure p2 is built up slowly.

Duration t of the pressure build-up is adjusted with the flow control screw attached to the cover. The output pressure rises depending on the flow control setting. When the switch-through pressure is reached (approx. 50% of operating pressure p1), the valve's main seat opens → Fig. 11. The product now pressurises the system at full flow.

8 Operation



The mechanical system of the product is not tested when it is pressurised.

- Perform a forced switch-off at least once a month if the process-related switching frequency is lower.
-



The pause period after exhausting is 2 s. This period must always be complied with. Only then can pressurisation be repeated.

9 Maintenance

9.1 Maintenance work

NOTICE

Failure of the safety function

Clogging of the cushioning body of an unsuitable silencer may result in reduced bleeding (back pressure). This may result in failure of the safety function.

- Use the silencer UOS-... intended for the device exclusively.
-

- Check the silencer regularly and replace if necessary.

9.2 Cleaning

1. Switch off energy sources:
 - Operating voltage
 - Compressed air
2. Clean the outside of the product as required. Approved cleaning agents are soap solutions (max. +50 °C), petroleum ether and all non-abrasive cleaning agents.

10 Malfunctions

10.1 Diagnostics

LED display

Operating statuses and errors are indicated by flashing light-emitting diodes.

Power LED (green)	Error LED (red)	Meaning
Off	Off	Operating voltage not applied
lights for approx. 6 s after switch on	lights for approx. 6 s after switch on	Product runs through all tests during start-up
flashes once a second	Off	Product is in exhausted status
continuously on	Off	Product is in pressurised status
		Product is waiting for the signal (S34) with monitored start
4x briefly	flashes once a second	error code

Tab. 8: LED display

Display of error codes

The error code is displayed by 4 short flash pulses of the Power LED (green). Then the Error LED (red) displays the error code (number of flash pulses = error code). The flash pulses for both LEDs repeat continuously. The LEDs only stop flashing when the operating voltage is switched off in order to clear the error.

Overview of error codes:

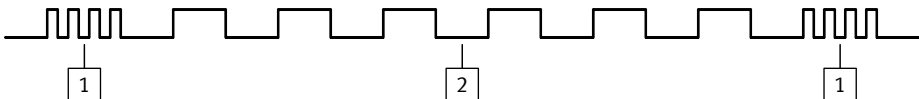


Fig. 18: Example of error code

After 4 short flash pulses of the Power LED 1, there are 6 long flash pulses of the Error LED 2. This indicates error code 6 (pneumatic fault). A pneumatic fault occurs, for example, if the operating pressure is below the required minimum pressure or there is no pressure at all.

10.2 Fault clearance

- Check compressed air supply
- Check power supply
- Check installation of the signal lines
- Start device.
- If the fault occurs again: contact Festo service → www.festo.com.

Malfunction/ error code	Possible cause	Remedy
2	Bouncing on the enable signals	- Make sure that only debounced contacts are used (e.g. for protective guards or doors).
5	Power supply is insufficient	- provide sufficient power supply.
	Power unit is not correctly dimensioned; voltage collapses	- use a sufficiently dimensioned power unit.
6	Pressure supply was interrupted	- Restore compressed air supply.
8	Enable signals outside the specification	- Comply with specification.
	Multi-pin plug socket NECA or cable is defective	- NECACheck multi-pin plug socket or wiring and replace if defective.
Additional Error Codes	PLC emits test pulses that are offset to the enable signals	- Switch off test pulses. - Use MP5 plug connector.
	Malfunction due to electrical or electromagnetic effects (EMC information not in compliance)	- note maximum length of the signal lines. - Connect earthing correctly. - maintain minimum wall distance. - do not install cables behind the product.
Pressure p1 collapses briefly at every switching operation	The cross-section of the product pressure supply is too small	- Tighten flow control screw. - Attach reservoir in front of p1 inlet. - Adjust compressed air supply, e.g. increase cross section of the supply line.

Tab. 9: Fault clearance

11 Disassembly

1. Switch off energy sources:
 - Operating voltage
 - Compressed air
2. Separate the applicable connections from the product.

12 Technical Data

12.1 Technical data, mechanical

MS6-SV-E	
Type of mounting	In-line installation with accessories
Design	Piston seat has no underlap
Position sensing principle	Piston magnet principle
Reset method	mechanical spring
Mounting position	any
Sound pressure level [dB(A)]	75 with silencer UOS-1
Environmental conditions	
Shock resistance	Shock test with severity level 2 in accordance with EN 60068-2-27
Vibration resistance	with severity level 2 in accordance with EN 60068-2-6
Degree of protection	
Degree of protection	IP65
Note	with multi-pin plug socket NECA
Materials	
Housing	Die-cast aluminium
Seal	NBR

Tab. 10: Technical data, mechanical

12.2 Technical data, pneumatic

MS6-SV-E	
Pneumatic port 1, 2 [G]	1/2
Pneumatic port 3 [G]	1
Pilot air supply	internal
Exhaust function	cannot be throttled

MS6-SV-E		
Manual override		none
Type of control		piloted
Valve function		3/2-way valve, single solenoid, closed Soft-start function
Medium		
Operating medium		Compressed air according to ISO 8573-1:2010 [7:4:4] and inert gases
Note		lubricated operation possible, required for further operation
Temperature		
Medium	[°C]	-10 ... +50
Environment	[°C]	-10 ... +50
Bearing	[°C]	-10 ... +50
Operating pressure		
Operating pressure	[bar]	3.5 ... 10
Residual pressure in normal operation	[bar]	0 (no residual pressure)
Residual pressure in the event of error	[bar]	≤ 0.4 (at p ₁ = 10 bar and flow control fully open)
C value	[l/(s bar)]	19.3
B value		0.21
Characteristic flow rate values		
Standard nominal flow rate 1 → 2	[l/min]	4300 (at p ₁ = 6 bar, p ₂ = 5 bar)
Standard flow rate 2 → 3	[l/min]	9000 (at p ₁ = 6 bar)
Standard flow rate 2 → 3 in the event of a critical fault	[l/min]	≥ 6000 (at p ₁ = 6 bar)
Switch-through point		Approx. 50% of p ₁
Filling flow		adjustable by flow control valve
minimum pause time after exhaust	[s]	≥ 2

Tab. 11: Technical data, pneumatic

12.3 Technical Data, Electrical

MS6-SV-E		
Actuation type		Electrical
Switching frequency	[Hz]	≤ 0.5
Electrical connection		Sub-D, 9-pin, only with multi-pin plug sockets NECA-S1G9-P9-MP...
Degree of protection		IP65 with multi-pin plug socket NECA
Protection against electric shock (protection against direct and indirect contact in accordance with EN/IEC 60204-1)		by PELV fixed power supply
Switching position indicator		LED and potential-free contact
Operating voltage		
Nominal operating voltage DC	[V]	24
Current consumption	[A]	≤ 0.12 ¹⁾
Voltage fluctuations		
Permissible voltage fluctuations	[%]	±10
Switching time		
Switching time off	[ms]	40
Switching time on	[ms]	130
Duty cycle	[%]	100
Semiconductor relay (signal contact)		
Voltage	[V]	≤ 60
continuous current	[A]	≤ 0.12
Resistance in switched-on status	[Ω]	≤ 25
Leakage current in switched-off status	[μA]	≤ 1
Protection class		III

1) A high starting current will apply briefly when switching on.

Tab. 12: Technical Data, Electrical

12.4 Safety characteristics

Approval information, safety engineering	
CE	
Type-examination	The functional safety engineering of the product has been certified by an independent testing body, see EC-type examination certificate → www.festo.com/sp
Certificate issuing authority	IFA, Certification Body of Machinery, NB 0121
Certificate no.	IFA 2101219
UKCA	
Type-examination	The functional safety engineering of the product has been certified by an independent body, see UK-type examination certificate → www.festo.com/sp
Certificate issuing authority	Intertek Testing & Certification LTD, Approved Body for Machinery, No. 0359
Certificate no.	UK-MCR-0086

Tab. 13: Approval information, safety engineering

Type	MS6-SV-E
Conforms to standard	EN ISO 13849-1
	EN ISO 13849-2
	EN 61508-1:2010-05
Safety function	safe venting and protection against unexpected start-up (pressurisation)
Performance Level (PL)	Category 4, PL e
Safety Integrity Level (SIL)	SIL 3
Service life characteristic B10 according to ISO 19973-1:2015	0.9 mill. switching cycles
Service life value at maximum approved operating pressure	0.9 mill. switching cycles
Service life [years]	20

Type	MS6-SV-E
Probability of dangerous failure per hour (PFH _D)	
PFH _D for the electronic part of the product	4.08 E-9 h ⁻¹
PFH _D for the entire device ¹⁾	5.19 E-9 h ⁻¹
CCF measures	Maintain operating pressure limits
	Comply with temperature range
	Comply with permissible load
	Observe compressed air quality
Note on forced checking procedure	Switching frequency min. 1/month

1) This calculation is based on an actuation rate averaging once per hour for 365 days and 24 hours. It is calculated with B10D = 2 x B10.

Tab. 14: Safety characteristics

12.5 Filling flow

Flow rate q_n dependent on the number of rotations n of the flow control screw

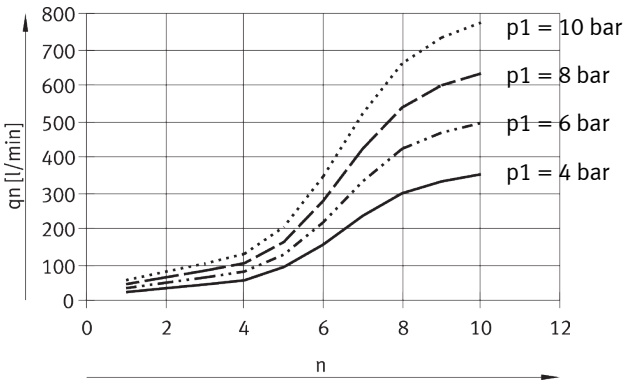


Fig. 19: Flow diagram

12.6 Exhaust time

The following table shows the exhaust time in normal operation (N) and in the event of a fault (F) for different volumes and operating pressures.

NOTICE

In the case of a fault (F) the worst possible fault in the valve's interior is assumed (worst case).

Normal operation: N Fault case: F		Operating pressure 3.5 bar		Operating pressure 6 bar		Operating pressure 10 bar		
		Exhaust time [s] to 1.0 bar	Exhaust time [s] to 0.5 bar	Exhaust time [s] to 1.0 bar	Exhaust time [s] to 0.5 bar	Exhaust time [s] to 1.0 bar	Exhaust time [s] to 0.5 bar	
Volume [l]	2	N	0.1	0.2	0.24	0.3	0.3	0.4
		(F)	(0.16)	(0.22)	(0.28)	(0.35)	(0.36)	(0.52)
	10	N	0.3	0.45	0.55	0.7	0.7	0.9
		(F)	(0.4)	(0.6)	(0.8)	(1.1)	(1.2)	(1.9)
	20	N	0.5	0.85	1.0	1.3	1.4	1.7
		(F)	(0.8)	(1.25)	(1.5)	(2.2)	(2.4)	(3.9)
	40	N	1.2	1.9	2.2	3.0	3.0	3.9
		(F)	(1.7)	(2.8)	(3.4)	(5.3)	(5.1)	(8.1)
	150	N	3.2	5.0	6.0	8.2	11.0	12.8
		(F)	(4.8)	(8.2)	(9.8)	(15.4)	(16.2)	(29.0)

Tab. 15: Exhaust time

12.7 Switching characteristics of the multi-pin plug sockets NECA-...-MP1, -MP3 und -MP5

12.7.1 Switching characteristics for multi-pin plug socket NECA-S1G9-P9-MP1

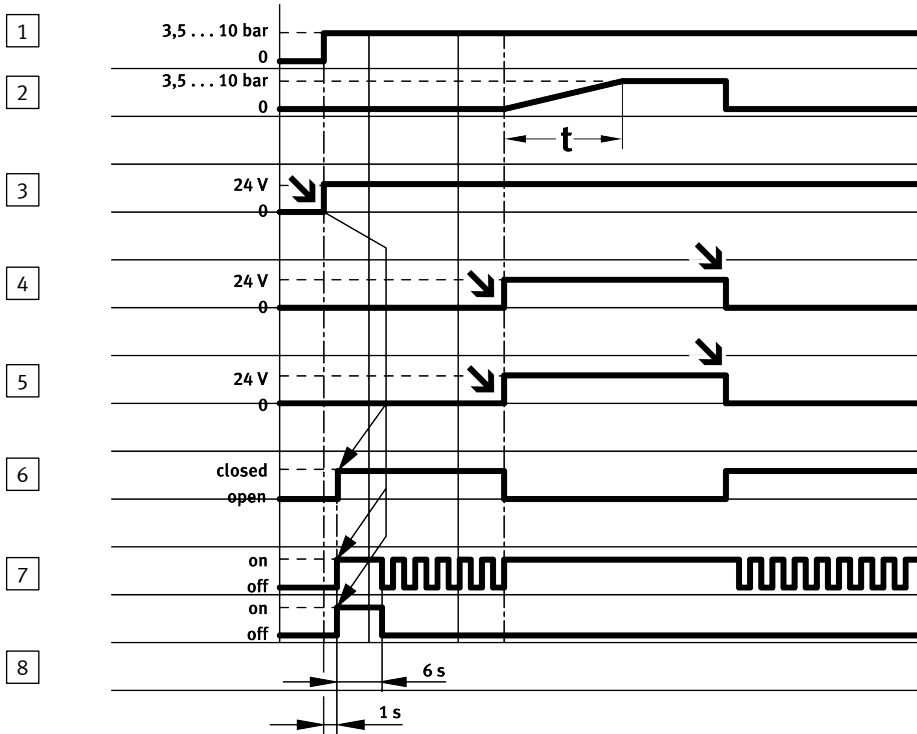


Fig. 20: Input and output switching characteristics in normal operation (when automatic start mode of operation is set) for multi-pin plug socket NECA-S1G9-P9-MP1

- | | |
|--------------------------|------------------------|
| 1 Operating pressure p1 | 5 EN2: Enable signal 2 |
| 2 Outlet pressure p2 | 6 Signal contacts |
| 3 +L1: operating voltage | 7 Power LED (green) |
| 4 EN1: Enable signal 1 | 8 Error LED (red) |

NOTICE

- Pulses at inputs EN1 and EN2 from 0 to 24 V, of ≤ 3 ms duration do not send an error message to the product.
- Pulses at inputs EN1 and EN2 from 24 to 0 V, of ≤ 12 ms duration do not send an error message to the product.

The following diagrams shows the exact switching characteristics of the Enable signals EN1 and EN2 with time offset. The maximum reaction time can be derived from the delay between the two signals.

EN2 before EN1 (for multi-pin plug socket NECA-S1G9-P9-MP1)

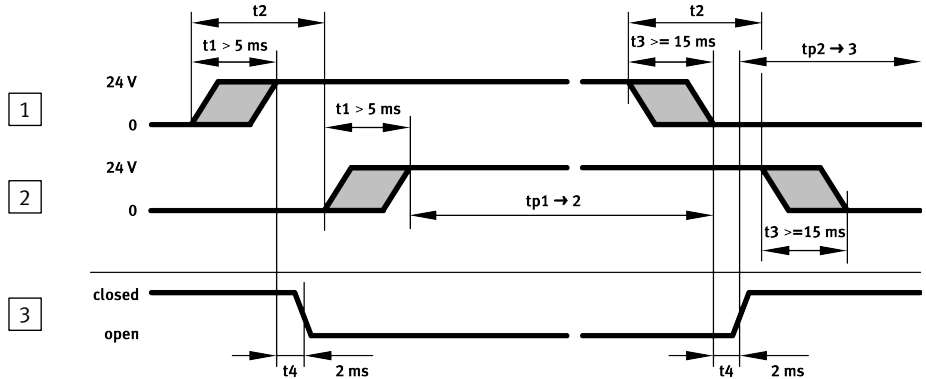


Fig. 21: Runtime performance of enable signals with NECA-....MP1

- 1 EN2: Enable signal 2
- 2 EN1: Enable signal 1
- 3 Signal contacts

Maximum reaction time from exhausting to pressurisation: $t_2 + t_1 = 75 \text{ ms} + 5 \text{ ms} = 80 \text{ ms}$
 Maximum reaction time from pressurisation to exhausting: $t_3 + t_4 = 15 \text{ ms} + 2 \text{ ms} = 17 \text{ ms}$

EN1 before EN2 (for multi-pin plug socket NECA-S1G9-P9-MP1)

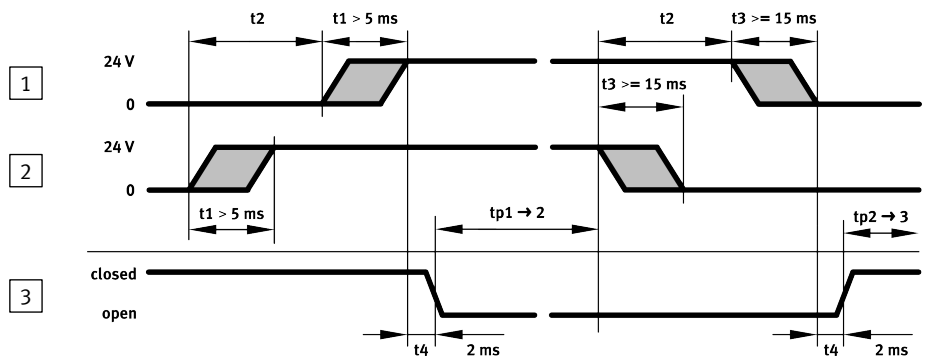


Fig. 22: Runtime performance of enable signals with NECA-....MP1

- 1 EN2: Enable signal 2
- 2 EN2: Enable signal 2
- 3 Signal contacts

Maximum reaction time from exhausting to pressurisation:
 $t_2 + t_1 + t_4 = 75 \text{ ms} + 5 \text{ ms} + 2 \text{ ms} = 82 \text{ ms}$

Maximum reaction time from pressurisation to exhausting:

$$t2 + t3 + t4 = 75 \text{ ms} + 15 \text{ ms} + 2 \text{ ms} = 92 \text{ ms}$$

Runtime performance	
t1 > 5 ms:	Level of EN2/EN1 must be HIGH for min. 5 ms (debounce time/input filter/stabilisation time).
t2 < = 75 ms:	maximum permissible delay time between EN1 and EN2. If exceeded, the product is not pressurised and an error message is output.
t3 > = 15 ms:	Level of EN2/EN1 must be LOW for min. 15 ms (debounce time/input filter/stabilisation time).
t4 = 2 ms:	maximum internal time delay caused by the program sequence.
tp1 → 2:	Pressurisation > 300 ms
tp2 → 3:	Exhausting > 1 s

Tab. 16: Runtime performance

12.7.2 Switching characteristics for multi-pin plug socket NECA-S1G9-P9-MP3/-MP5

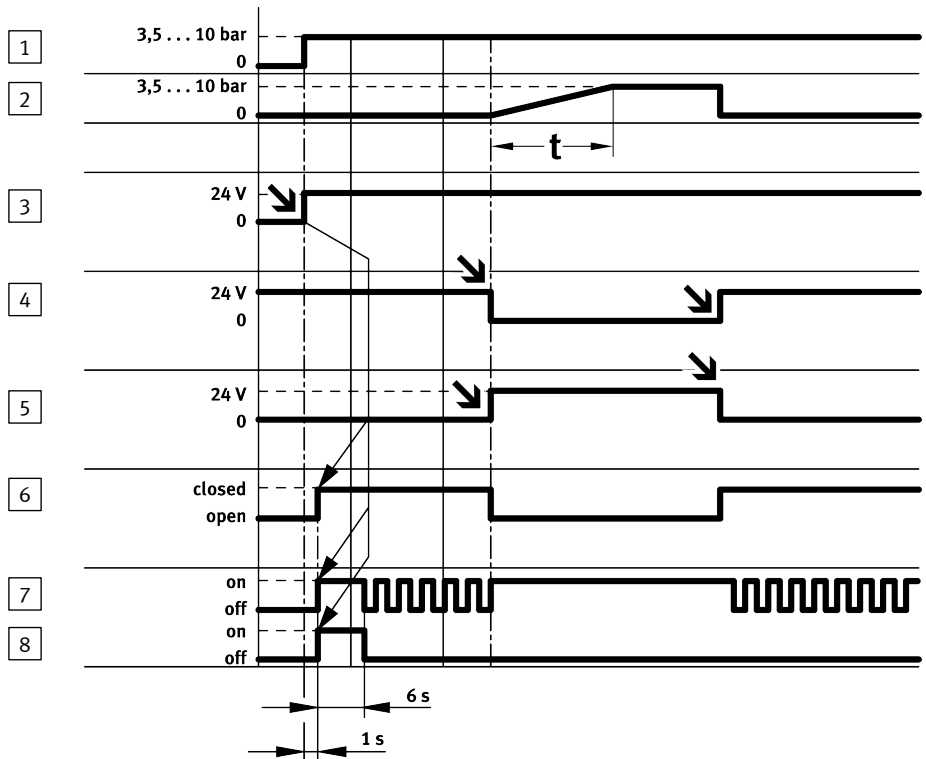


Fig. 23: Input and output switching characteristics in normal operation (when automatic start mode of operation is set) for multi-pin plug socket NECA-S1G9-P9-MP3/-MP5

- | | | | |
|---|------------------------|---|----------------------|
| 1 | Outlet pressure p2 | 5 | EN2: Enable signal 2 |
| 2 | Ausgangsdruck p2 | 6 | Signal contacts |
| 3 | +L1: operating voltage | 7 | Power LED (green) |
| 4 | EN1: Enable signal 1 | 8 | Error LED (red) |

Exhausting and output of an error message at NECA-...-MP3:

- EN1 and EN2 = 0 V (LOW)
- EN1 and EN2 = 24 V (HIGH)

Exhausting and output of no error message at NECA-...-MP5:

- EN1 and EN2 = 0 V (LOW)
- EN1 and EN2 = 24 V (HIGH)

The following diagrams shows the exact switching characteristics of the Enable signals EN1 and EN2 with time offset. The maximum reaction time can be derived from the delay between the two signals.

EN2 before EN1 (for multi-pin plug socket NECA-S1G9-P9-MP3/-MP5)

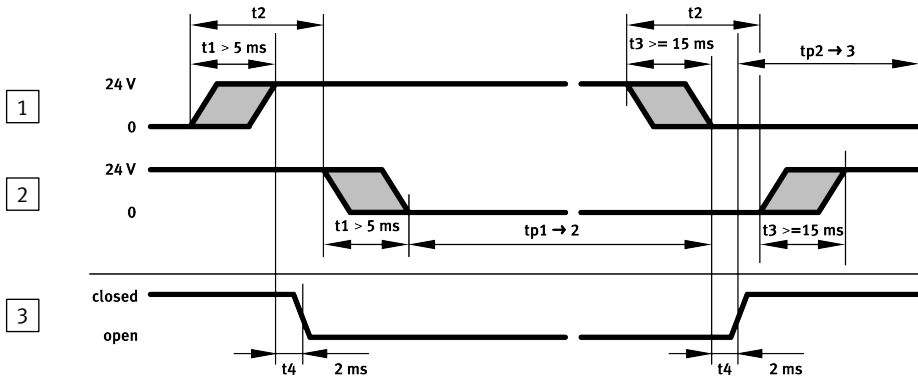


Fig. 24: Runtime performance of enable signals with NECA-...-MP3/-MP5

- 1 EN2: Enable signal 2
- 2 EN1: Enable signal 1
- 3 Signal contacts

Maximum reaction time from exhausting to pressurisation: $t_2 + t_1 = 75\text{ ms} + 5\text{ ms} = 80\text{ ms}$

Maximum reaction time from pressurisation to exhausting: $t_3 + t_4 = 15\text{ ms} + 2\text{ ms} = 17\text{ ms}$

EN1 before EN2 (for multi-pin plug socket NECA-S1G9-P9-MP3/-MP5)

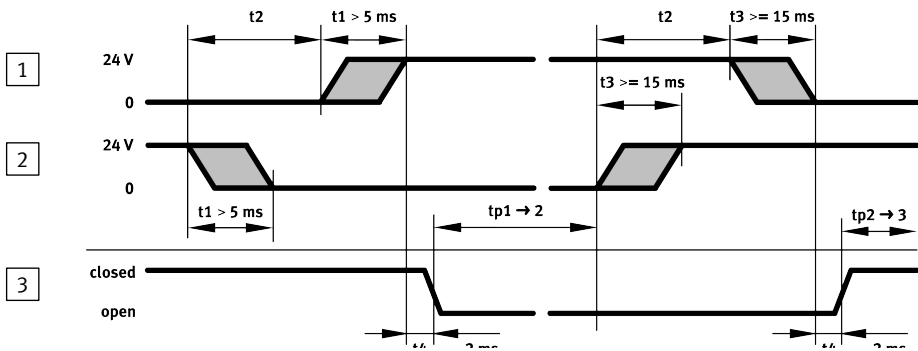


Fig. 25: Runtime performance of enable signals with NECA-...-MP3/-MP5

- 1 EN2: Enable signal 2
- 2 EN1: Enable signal 1
- 3 Signal contacts

Maximum reaction time from exhausting to pressurisation: $t_2 + t_1 + t_4 = 75\text{ ms} + 5\text{ ms} + 2\text{ ms} = 82\text{ ms}$

Maximum reaction time from pressurisation to exhausting:

$t_2 + t_3 + t_4 = 75\text{ ms} + 15\text{ ms} + 2\text{ ms} = 92\text{ ms}$

Runtime performance of enable signals	
t1 > 5 ms:	Level of EN2 (EN1) must be HIGH (LOW) for min. 5 ms (debounce time/input filter/stabilisation time).
t2 < = 75 ms:	maximum permissible delay time between EN1 and EN2.
	Exceeding maximum permissible delay time: - Product is not pressurised and an error message is output (NECA-...-MP3) - Product is not pressurised and an error message is output (NECA-...-MP5)
t3 > = 15 ms:	Level of EN2 (EN1) must be LOW (HIGH) for min. 15 ms (debounce time/input filter/stabilisation time).
t4 = 2 ms:	maximum internal time delay caused by the program sequence.
tp1 → 2:	Pressurisation > 300 ms
tp2 → 3:	Exhausting > 2 s

Tab. 17: Runtime performance of enable signals

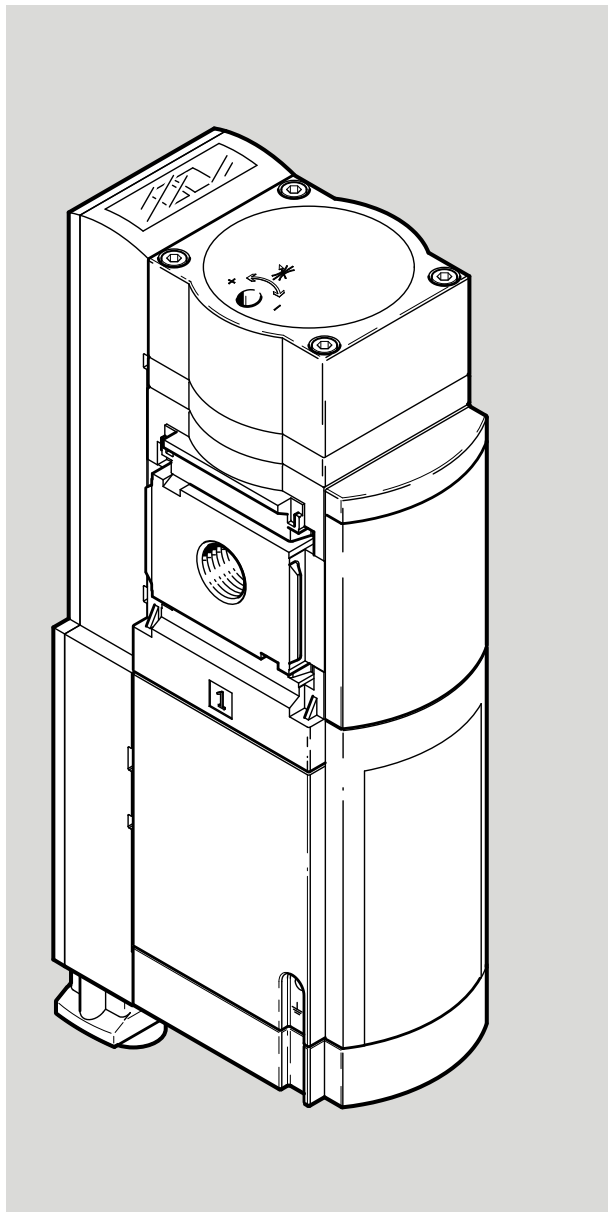
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MS6(N)-SV-...-E-ASIS

Soft start/quick exhaust valve



FESTO

Instructions |
Assembly, Installation,
Safety func.



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2019-05a
[8111060]

Translation of the original instructions

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1 Applicable documents



All available documents for the product → www.festo.com/pk.

1.1 Specified standards

Standard	Title
EN ISO 13849-1:2008-06	Safety of machinery - Safety-related parts of control systems Part 1: General principles for design
EN ISO 13849-2:2008-06	Safety of machinery - Safety-related parts of control systems Part 2: Validation
EN 50295:1999-10	Low-voltage switching devices, control and device interface; Actuator Sensor Interface (AS-interface)
EN 60204-1:2006-06	Safety of machinery - Electrical equipment of machines Part 1: General requirements
EN 61508-3:2010-05	Functional safety of safety-related electrical/electronic/programmable electronic systems Part 3: Software requirements
IEC 62026-2:2008-01	Low-voltage switching devices - control device networks (CDIs) Part 2: Actuator Sensor Interface (AS-i)
EN ISO 4414:2010-11	Fluid engineering - General rules and safety requirements for pneumat- ic systems and their components

Tab. 1 Standards

2 Safety

2.1 Safety instructions

- Only use the product in original status without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Observe labelling on the product.
- Take into consideration the ambient conditions at the location of use.
- Prior to mounting, installation and maintenance work: Switch off power supply and secure it from being switched back on.
- Observe tightening torques. Unless otherwise specified, the tolerance is $\pm 20\%$.

2.2 Intended use

The product is intended solely for fast and safe venting and for building up pressure gently in pneumatic piping systems and terminals in industry.

Additional information

The product is exclusively designed for use in bus systems in accordance with the AS-Interface specification (SPEC 3.0, Profile 7.5.5).

The product is intended for installation in a machine or automated system and must be used exclusively as follows:

- In an industrial environment
- Within the limits of the product defined by the technical data → 14 Technical data.
- In its original condition, without unauthorised modifications
- In perfect technical condition
- In standard operation, which includes standstill, set-up and service operation, as well as emergency operation

2.3 Foreseeable misuse

The following examples of foreseeable misuse are among those not approved as intended use:

- Outdoor use
- Use as press safety valve
- Bypass of the safety function
- Use in reversible operation (using supply air instead of exhaust air, and vice versa)
- Vacuum operation

2.4 Training of qualified personnel

Installation, commissioning, service and disassembly should only be conducted by skilled personnel. The skilled personnel must be familiar with the installation of electrical and pneumatic control systems.

3 Additional information

- Accessories → www.festo.com/catalogue.
- Spare parts → www.festo.com/spareparts.

4 Service

Contact your regional Festo contact person if you have technical questions → www.festo.com.

5 Product overview

5.1 Design

5.1.1 Product design

The product corresponds to category 3 + 4 with a maximum achievable performance level e in accordance with EN ISO 13849-1.

Product overview

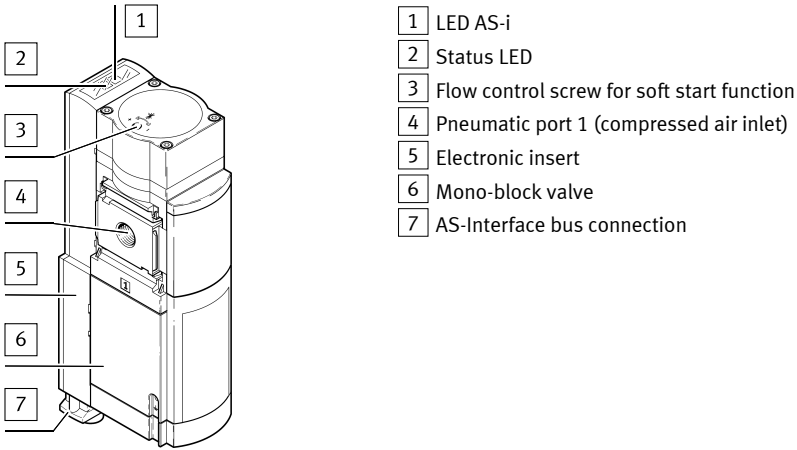


Fig. 1 Operating elements and connections

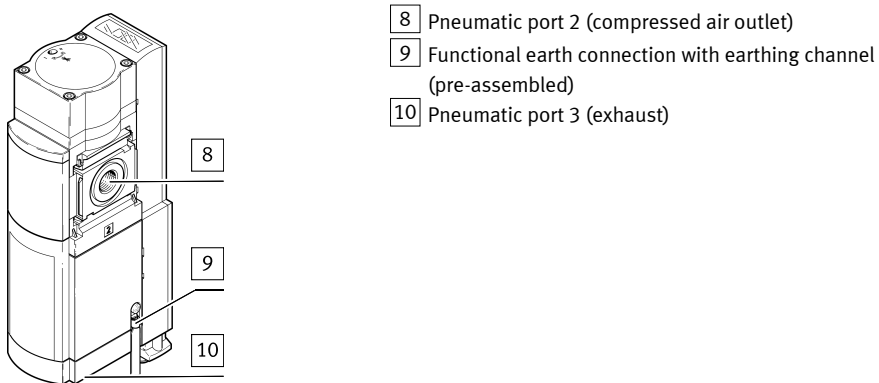


Fig. 2 Operating elements and connections

5.2 Function

The product is a self-testing, redundant mechatronic system that meets the requirements of the EN ISO 13849-1+2 and guarantees the pneumatic safety function, safe venting, even in the event of a fault in the valve, e. g. due to wear or contamination. Another safety function of the product is the protection against unexpected start-up after EN 1037.

Via the safety-related electrical connection, the product is connected as a slave to the AS-i-Safety at Work environment without additional devices.

Definitions of terms AS-Interface

Term	Description
Master	Component for data transmission that controls the logical and temporal behaviour on the AS-i line.
Safety monitor	Component that monitors the safety-related slaves and the correct functioning of the network. The AS-i safety monitor is configured and commissioned via a PC/notebook with the configuration software AS-iMon.
Slave	Component for data transmission that is addressed cyclically by the master via its address and only then generates an answer.
AS-iMon	Configuration software for the AS-i network

Tab. 2 Definitions of terms AS-Interface

Brief description AS-i

The actuator-sensor interface (AS-i) is a system for networking sensors and actuators at the lowest level of the automation hierarchy. It is a manufacturer-independent, open bus system and enables data and power transmission on just one line. This simple application enables an economical design with reliable operating performance at the same time. The network topology of the AS-i system is arbitrary and easily expandable.

A AS-i network consists of a control unit, a so-called master, and the associated sensor and actuator components, the slaves. The master polls all configured slaves cyclically and exchanges the input and output data with them. A telegram consists of 4-bit user data. The master communicates with the participants using a serial transmission protocol.

With AS-i Safety at Work, a certified standard has been developed that enables the use of safety-related components, e. g. MS6(N)-SV-...-E-ASIS in the AS-i system. The safe AS-i system is intended for safety applications up to category 4 according to EN ISO 13849-1PL e. Mixed operation of standard components and safety-related components is possible. The AS-i master considers the safety-related slaves like all other slaves and integrates them into the network. The transmission protocol and the lines of the AS-i system are designed in such a way that they can also transmit safety-oriented telegrams.

The AS-i safety monitor is the central safe element and monitors the safety-related slaves assigned to it within a AS-i system. The safety function is achieved by the additional signal transmission between the safety-related slaves and the AS-i safety monitor. This transmission takes place using a special security protocol.

In the event of a stop request or a defect, the AS-i safety monitor safely switches off the system in protective mode with a reaction time of max. 40 ms.

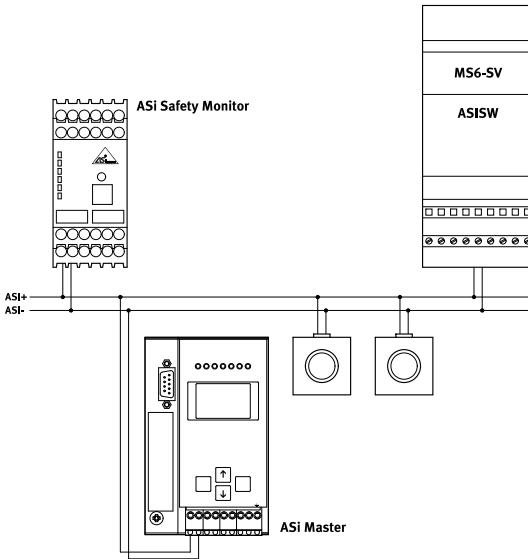


Fig. 3 Example AS-i Safety at Work

5.3 Safety function in accordance with EN ISO 13849

NOTICE!

Failure of the safety function.

The product must be switched off at least once a month to guarantee the safety function.

NOTICE!

Failure of the safety function.

If control measures to handle “common cause failures” (CCF) are not complied with, the safety function of the soft start/quick exhaust valve can be impaired.

- Make sure that the described measures observed
 - Failures due to a common cause (Common Cause Failure – CCF) and
 - 14.4 Safety engineering characteristics.

NOTICE!

Failure of the safety function.

Non-compliance with the technical data can lead to loss of the safety function.

For the safety functions, the product has control characteristics with which a performance level e can be achieved.

This product has been designed and manufactured in accordance with the fundamental and reliable safety principles of EN ISO 13849-2.

The following requirements apply to the manager:

- Specifications on mounting and operating conditions in these operating instructions must be observed.
- For use in higher categories (2 to 4), the requirements of EN ISO 13849, e. g. CCF, must be considered.
- The basic safety principles of EN ISO 13849-2 relating to implementation and operation of the component must be satisfied. For categories 2 to 4, the proven safety principles must be fulfilled in accordance with EN ISO 13849-2 for the implementation and operation of the component.
- When using this product in machines or systems subject to specific C standards, it must be in compliance with the requirements specified in the standards.
- Before using the product, a risk assessment in accordance with the EC Machinery Directive 2006/42/EG, Appendix I, Paragraph 1 and 1.1.2 is required.
- The user is responsible for coordinating all applicable safety regulations and rules with the competent authority and for compliance with regulations and rules.

Failures due to a common cause (Common Cause Failure – CCF)

Common cause failures cause the loss of the safety function, since in this case both channels in a two-channel system fail simultaneously.

The following measures ensure that common cause failures are avoided:

- Compliance with the permissible values for vibration and shock stress
- Compliance with the temperature range
- Compliance with compressed air quality as specified in the technical data, in particular avoiding flash rust particles (such as caused by servicing work) as well as compliance with the residual oil content of max. 0.1 mg/m³ when using ester-containing oils (which may, for example, be contained in the compressor oil)
- Compliance with the maximum operating pressure, if necessary with a pressure-relief valve
- Clogging of the silencer must be avoided → Fig.4.

6 Assembly

NOTICE!

In order to ensure electromagnetic compatibility in accordance with the EMC Directive, note the following:

- Ensure a wall clearance of 32 mm, e. g. with the MS6-WPB mounting bracket.
- Do not lay cables between the wall and the product.

NOTICE!

Failure of the safety function.

Failure to comply with the minimum distance of 15 mm between the silencer and base can result in the loss of the safety function.

- Observe minimum distance of 15 mm below the silencer → Fig.4.
The free space ensures the exhaust can escape.

- Place product as close as possible to the installation site
- The product can be mounted in any position

Assembly

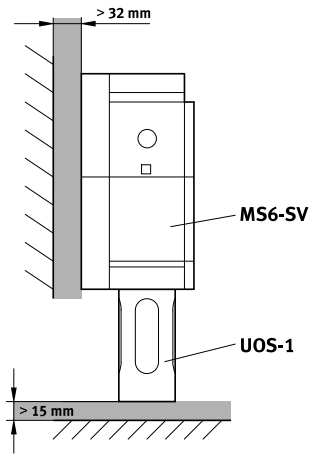


Fig. 4 Installation

- Observe the flow direction 1 to 2. The numerals 1 on the product housing serve as orientation.

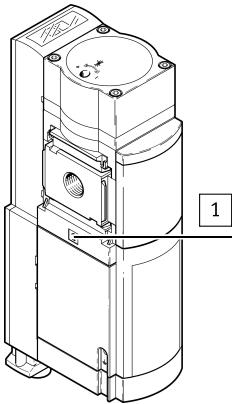


Fig. 5 Flow direction

6.1 Assembly with MS-series service unit components

⚠ WARNING!

Failure of the safety function.

Incorrect installation in the service unit combination can result in failure of the exhaust safety function.

- Only devices that do not impair the exhaust process, even after a possible malfunction of the device, may be placed downstream from the MS6-SV-....

Installation

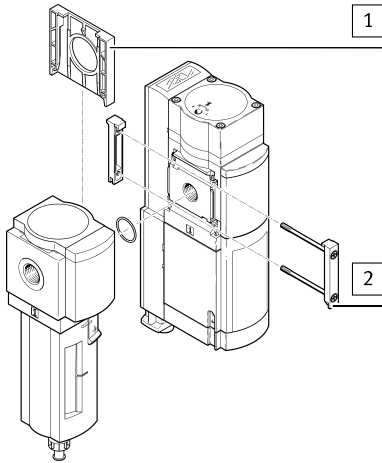


Fig. 6 Assembly

1. Slide the cover cap MS6-END **1** upwards and remove it.
2. Insert a seal **2** between the individual devices (module connector MS6-MV in scope of delivery).
3. Place module connector **2** in the slots of the individual devices.
4. Fasten the module connector with two screws (product scope of delivery). Tightening torque: maximum 1.2 Nm.

7 Installation

7.1 Pneumatic installation

Port 1 and 2

If using screw connectors:

- Note the screw-in depth of the connector thread: 10 mm.
- Make sure that the compressed air lines are connected correctly.
- Screw the connectors into the pneumatic connections using a suitable sealing material.

Port 3 (thread size G1 or NPT1)



Exhausting a system using the product results in high noise levels.

- Recommendation: use silencer → www.festo.com/catalogue.

- Screw the silencer into pneumatic port 3.
- Make sure exhaust has no obstacles: do not block silencer or port 3.



For the product, an adapter (from thread size NPT1 to G1) must also be mounted between the silencer and the product.

7.2 Electrical installation

⚠ WARNING!

Risk of injury due to electric shock.

- For the electrical power supply, use only PELV circuits in accordance with IEC 60204-1/EN 60204-1 (Protective Extra-Low Voltage, PELV).
 - Observe the general requirements of IEC 60204-1/EN60204-1 for PELV circuits.
 - Only use voltage sources that ensure a reliable electric separation from the mains network in accordance with IEC 60204-1/EN 60204-1.
-

Connect earthing cable

- Connect the pre-assembled earth strap to the earth potential with low impedance (short cable with large cross-section).

This prevents malfunctions due to electromagnetic interference and ensures electromagnetic compatibility in accordance with the EMC Directives.

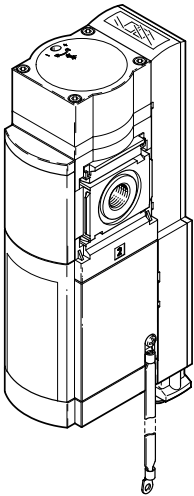


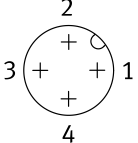
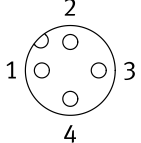
Fig. 7 Earth cable connection

Connecting the AS-i bus

The following must be observed for branch lines:

- The maximum total length of the AS-i bus: 100 m without repeater/extender
- The cable length of the load voltage connection (depending on the current consumption and the fluctuations of the load voltage).

Connection to the M12 plug connector

M12 plug, 4-pin (In)	M12 bushing, 4-pin (Out)
	
Pin 1: AS-i +	Pin 1: AS-i +
Pin 2: n. c.	Pin 2: addressing contact -
Pin 3: AS-i -	Pin 3: AS-i -
Pin 4: n. c.	Pin 4: addressing contact +

Tab. 3 Connection AS-i-Interface-Bus

i

Seal unused connections with suitable protective caps → www.festo.com/catalogue.

AS-Interface addresses

Before commissioning, a non-safety-related slave address and a safety-related slave address must be assigned to the product.

The modules or slaves that have been addressed must be labelled carefully.

Address allocation

Cyclic digital data

Inputs				Description
n. c.	n. c.	D11	D10	
		0	0	Exhaust pneumatic condition
		0	1	Pressurise pneumatic condition
		1	0	Soft error; pneumatic limits exceeded / not reached
		1	1	Serious error; defect in hardware / software uncovered

Tab. 4 Inputs for cyclic digital data

Outputs				Description
DO3	DO2	n. c.	n. c.	
x	x			Not used

Tab. 5 Outputs for cyclic digital data

Cyclic analogue values

A15 ... A0	Description
xxxxxxxxxxxxxxxxxxxx	Pressure p1

Tab. 6 Outputs for cyclic analogue values

A15 ... A0	Description
xxxxxxxxxxxxxxxxxxxx	Pressure p2

Tab. 7 Outputs for cyclic analogue values

Acyclic values

Data format of diagnostic AS-i object 00 (17 bytes)																
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Meaning:																
0	Vendor ID (high Byte)										Value 01 _{hex}					
1	Vendor ID (low Byte)										Value 4D _{hex}					
2	Device ID (high Byte)										Value 03 _{hex}					
3	Device ID (low Byte)										Value A6 _{hex}					
4	Specification of the analogue inputs/outputs										Value 03 _{hex}					
5 ... 20	Product key										Value xx _{hex}					
21	Switching cycle counter valve (low Byte)										Value xx _{hex}					
22	Switching cycle counter valve										Value xx _{hex}					
23	Switching cycle counter valve										Value xx _{hex}					
24	Switching cycle counter valve (high Byte)										Value xx _{hex}					
25	Monthly counter										Value xx _{hex}					

Tab. 8 Data format of diagnostic AS-i object 00

Data format of diagnostic AS-i object 01 (16 bits)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Meaning															
0		Pneumatic error: minimum operating pressure not reached ($p_1 < p_{1,min.}$ 3.5 bar)													
1		Pneumatic error: maximum operating pressure exceeded ($p_1 < p_{1,min.}$ 10 bar)													
2		Self-test: 0 = not ready for operation 1 = ready for operation													
3		Internal error. Leads to shutdown and lockout													
4		Overrun tmin (1/month)													
5		Status AUX1, e. g. AS-i communication error													
6		Status AUX2													
7 ... 12		Unassigned													
13 ... 15		Internal valve diagnostics													

Tab. 9 Data format of diagnostic AS-i object 01

Assigning the AS-i address



Recommendation: use the addressing device ASI-PRG-ADR with connecting cable KASI-ADR from Festo. The addressing device scans the slave connected to the addressing device.

Addressing for safety-related slave:

1. Insert the AS-i configuration plug CACC-CP-AS into the M12 bushing.
 - ↳ The mode switch changes from run to prog.
2. Assign the desired address to the slave with an addressing device or with the AS-i master. Permissible address range 1 ... 31. Factory setting: address #0.
3. Check the address with the addressing device or AS-i master.
4. Check ID-Code. This must be F_{hex} .
5. Check ID1-Code. This must contain the 10th digit of the safety address.
6. Check ID2-Code. This must contain the 1st digit of the safety address.
7. Check IO-Code. This one must be 7.
8. If the verification of the codes was incorrect, repeat the procedure from step 1.
9. Disconnect the AS-i configuration plug CACC-CP-AS.
 - ↳ The mode switch changes from prog to run.

Addressing for non-safety-related slave:

1. Assign an unused address to each slave.
2. Connect the slave to the AS-Interface-Bus.

NOTICE!

Through use of the AS-i configuration plug CACC-CP-AS, pin 1–pin 4 and pin 2–pin 3 are connected to the AS-i connection plug. In this status, the valve goes into the addressing mode for the safe address. The address can now be set using AS-i-Master or an addressing device in accordance with SPEC V2.1. If the addressing device ASI-PRG-ADR is used, the valve must be supplied from an external voltage source. The addressing cable KASI-ADR must be used.

NOTICE!

If the safe address is set via the AS-i master, an address conflict may occur between the slave and monitor in the master.

The safe address of the slave is only registered on the bus when the AS-i configuration plug is plugged in. If the monitor is already logged in to the bus with the same address, the result is an address conflict.

8 Commissioning

The prerequisite for commissioning the product is the assignment of a non-safety-related slave address and an address of a safety-related slave.

1. Apply operating pressure p1.
 2. Switch on the AS-i operating voltage. The product runs a self-test for errors.
 - LED AS-i lights up green:
 - Status LED
 - Flashes green after successful self-test
 - Flashes red Operating pressure p1 is absent or outside the permissible range → 14 Technical data.
 - Lights up permanently red if the self-test → 11.2 Fault clearance is faulty.
If the self-test is successful, compressed air is briefly blown off the silencer.
- ↪ The product can be pressurised.
-

i

The valve is tested pneumatically in a self-test once an hour for as long as the product remains in this status. Operating pressure p1 must be applied; otherwise, the valve switches to malfunction.

3. Generate a safety-related AS-i telegram using the AS-i safety monitor.
 - The product changes to the pressurised state.
 - The status LED is permanently illuminated green.
 - The outlet pressure p2 is built up slowly.Duration t of the pressure build-up is adjusted with the flow control screw attached to the cover. The output pressure rises depending on the throttle setting → 14.6 Filling flow. When the switch-through pressure is reached (approx. 50% of operating pressure p1), the valve's main seat opens → 14.5 Switch-through pressure/filling time. The product is ready for operation (safety function safe venting).

9 Operation

i

The mechanical system of the product is not tested when it is pressurised.

- Perform a forced switch-off at least once a month if the process-related switching frequency is lower.

i

When designing the system, take into account the maximum switching frequency and the life rating of the product to ensure optimum availability → 14 Technical data.

10 Maintenance

10.1 Maintenance work

A dirty silencer can extend the time needed for exhausting the system and thus restrict the safety function.

- Check the silencer regularly and replace if necessary.

10.2 Cleaning

1. Switch off energy sources:
 - Operating voltage
 - Compressed air
2. Clean the outside of the product as required. Approved cleaning agents are soap solutions (max. +50 °C), petroleum ether and all non-abrasive cleaning agents.

11 Malfunctions

11.1 Diagnostics

LED display

LED AS-i	Diagnostics
Off	No AS-i voltage available
Illuminated green	AS-i interface voltage applied, no error
Illuminated red	AS-i address not set (equals 0)
Illuminated red	Failure of bus communication, e. g. watchdog expired
Flashes green/red	Error in exhaust valve

Tab. 10 Diagnostics LED AS-i

11.2 Fault clearance

Malfunction	Possible cause	Remedy
Output 2 exhausted, even though the safety circuit is closed.	Pressure supply was interrupted	<ul style="list-style-type: none"> – Restore pressure supply – Reset the AS-i slave (MS6-SV) Note: monitoring of the pressure via object 01
	Serious error (internal error)	Replace valve, contact Festo
	AS-i communication error	Check AS-i bus configuration
Serious error LED status lights up red	Pressure supply was interrupted	<ul style="list-style-type: none"> – Restore pressure supply – Reset the AS-i slave (MS6-SV) Note: monitoring of the pressure via object 01
	Hardware defect (mechanical or/and electronic)	Replace valve, contact Festo
Status 1 – Ready for operation is not achieved (self test not passed)	Lack of supply pressure	<ul style="list-style-type: none"> – Restore pressure supply – Reset the AS-i slave (MS6-SV)
	Supply pressure outside the pressure limits 3.5 - 10 bar	Check compressed air supply
	Hardware defect → malfunction, serious error	Replace valve, contact Festo
Pressure p1 collapses briefly at every switching operation	Non-underlap poppet valve → The behaviour is reinforced if the valve is operated with small volumes / hose diameters and the soft-start throttle is opened completely.	

Tab. 11 Fault clearance

12 Disassembly

1. Switch off the following energy sources for expansion:
 - Operating voltage
 - Compressed air
2. Separate the applicable connections from the product.

i

When using a commercially available silencer, the cushioning body may become clogged, which can result in reduced reduced exhaust performance and back pressure.

- Use the safety silencer that belongs to the device → www.festo.com/catalogue.

13 Disposal

ENVIRONMENT!

Send the packaging and product for environmentally sound recycling in accordance with the current regulations → www.festo.com/sp.

14 Technical data

14.1 Technical data, mechanical

Product	MS6-SV-...-E-ASIS	MS6N-SV-...-E-ASIS
Type of mounting	In-line installation With accessories	
Constructive design	Piston seat has no overlap	
Position sensing principle	Piston magnet principle	
Reset method	Mechanical spring	
Mounting position	Any	
Sound pressure level [dB(A)]	75 with silencer UOS-1	
Environmental conditions		
Shock resistance	Shock test with severity level 2 in accordance with FN 942017-5 and EN 60068-2-27	
Vibration resistance	Transport application test with severity level 2 in accordance with FN 942017-4 and EN 60068-2-6	
Degree of protection		
Degree of protection	IP65	
Note	With plug socket	
Materials		
Housing	Die-cast aluminium	
Seal	NBR	

Tab. 12 Technical data, mechanical

14.2 Technical data, pneumatic

Product	MS6-SV-...-E-ASIS	MS6N-SV-...-E-ASIS
Pneumatic connection 1, 2	G $\frac{1}{2}$ (ISO 228)	NPT $\frac{1}{2}$ -14
Pneumatic port 3	G1 (ISO 228)	NPT1

Technical data

Product		MS6-SV-...-E-ASIS	MS6N-SV-...-E-ASIS
Pilot air supply		Internal	
Exhaust function		Without flow control option	
Manual override		None	
Type of control		Piloted	
Valve function		3/2-way valve, monostable, closed Soft-start function	
Medium			
Operating medium		Compressed air according to ISO 8573-1:2010 [7:4:4]	
Note		Lubricated operation possible, in which case lubricated operation will always be required	
Temperature			
Medium	[°C]	-10 ... +50 (0 ... +50 with pressure sensor)	
Environment	[°C]	-10 ... +50 (0 ... +50 with pressure sensor)	
Bearing	[°C]	-10 ... +50 (0 ... +50 with pressure sensor)	
Operating pressure			
Operating pressure	[bar]	3.5 ... 10	
Residual pressure in normal operation	[bar]	0 (no residual pressure)	
Residual pressure in the event of error	[bar]	≤ 0.4 (at p1 = 10 bar and flow control fully open)	
C value	[l/(s bar)]	19.3	
B value	[l/(s bar)]	0.21	
Flow rate values			
Standard nominal flow rate 1 → 2	[l/min]	4300 (at p1 = 6bar, p2 = 5bar)	
Standard nominal flow rate 2 → 3	[l/min]	9000 (at p1 = 6 bar)	
Standard nominal flow rate 2 → 3 in the most critical error case	[l/min]	≥ 6000 (at p1 = 6 bar)	
Switch-through point		Approx. 50% of p1	
Filling flow		Adjustable by flow control	

Tab. 13 Technical data, pneumatic

14.3 Technical data, electrical

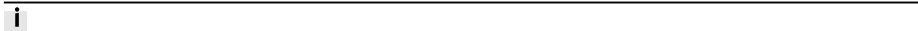
Product	MS6-SV-...-E-ASIS	MS6N-SV-...-E-ASIS
Actuation type	Electrical	
Switching frequency [Hz]	≤ 0.5	
Electrical connection	M12 plug M12 bushing	
Degree of protection	IP65 with plug socket	
Operating voltage		
Operating voltage range DC AS- Interface [V]	22.0 ... 31.6	
Switching time		
Switching time off [ms]	40	
Switching time on [ms]	130	
Duty cycle [%]	100	

Tab. 14 Technical data, electrical

14.4 Safety engineering characteristics

Type	MS6-SV- ... -E-ASIS	MS6N-SV- ... -E-ASIS
Conforms to standard	EN ISO 13849-1:2008-06	
	EN ISO 13849-2:2008-06	
Safety function	Exhausting	
Performance Level (PL)	Exhausting: category 4, PL e	
Safety Integrity Level (SIL)	Exhausting: SIL 3	
Service-life value B10	[million SP]	0.25
PFH	4.51 10E-9	
CCF measures	Maintain operating pressure limits	
	Comply with temperature range	
	Comply with vibration/shock limits	
	Comply with compressed air quality	
Note for Forced switch on/off	Switching frequency at least 1/month	
CE marking → Declaration of conformity	In accordance with EU Machinery Directive	
	In accordance with EU EMC Directive	
Type test	The functional safety engineering of the product has been certified by an independent testing laboratory → EC-type examination certificate (www.festo.com)	

Tab. 15 Safety engineering characteristics



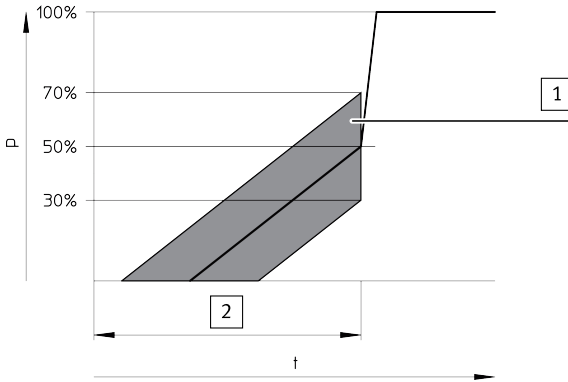
In addition to the system reaction time of max. 40 ms, the reaction times of the safe AS-Interface sensor slave must also be added.

The reaction times to be added can be found in the technical data of the slaves, sensors and actuators.

14.5 Switch-through pressure/filling time

The flow control screw in the cover generates a gradual pressure build-up of outlet pressure p2. The pressure rise can be adjusted by turning the flow control screw. If the outlet pressure p2 has reached approx. 50 % of the operating pressure p1, the valve opens and full operating pressure p1 is applied at the outlet.

Technical data



1 Tolerance range switching point

2 Filling time is adjustable via a flow control valve

Fig. 8 Switch-through pressure

Example:

If there is an operating pressure of $p_1 = 4$ bar with reference to the approved tolerance of $\pm 20\%$ switch-through pressure of 1.2 ... 2.8 bar is permissible.

14.6 Filling flow

Flow rate q_n dependent on the number of rotations n of the flow control screws

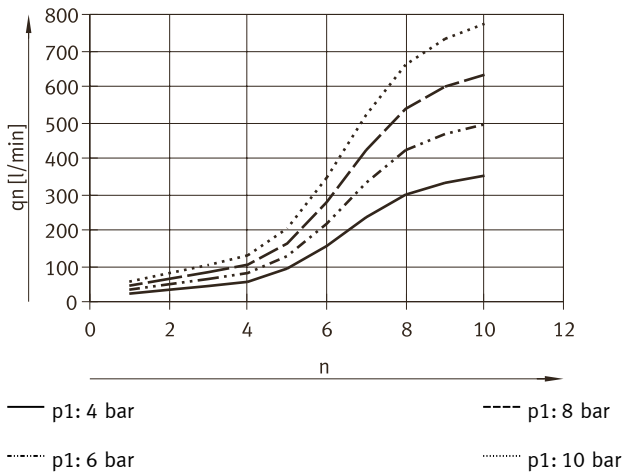


Fig. 9 Flow diagram

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Small volumes and hose diameters in combination with a filling flow rate that is too high can lead to malfunctions.

- Set the filling flow rate according to the selected connection size and the volume of the downstream system.

14.7 Exhaust time

The following table shows the exhaust time in normal operation (N) and in the event of a fault (F) for different volumes and operating pressures.

NOTICE!

In the case of a fault (F) the worst possible fault in the valve's interior is assumed (worst case).

Normal operation: N Fault case: F		Operating pressure 3.5 bar		Operating pressure 6 bar		Operating pressure 10 bar		
		Exhaust time [s]		Exhaust time [s]		Exhaust time [s]		
		to 1.0 bar	to 0.5 bar	to 1.0 bar	to 0.5 bar	to 1.0 bar	to 0.5 bar	
Volume [l]	2	N	0.1	0.2	0.24	0.3	0.3	0.4
		(F)	(0.16)	(0.22)	(0.28)	(0.35)	(0.36)	(0.52)
	10	N	0.3	0.45	0.55	0.7	0.7	0.9
		(F)	(0.4)	(0.6)	(0.8)	(1.1)	(1.2)	(1.9)
	20	N	0.5	0.85	1.0	1.3	1.4	1.7
		(F)	(0.8)	(1.25)	(1.5)	(2.2)	(2.4)	(3.9)
	40	N	1.2	1.9	2.2	3.0	3.0	3.9
		(F)	(1.7)	(2.8)	(3.4)	(5.3)	(5.1)	(8.1)
	150	N	3.2	5.0	6.0	8.2	11.0	12.8
		(F)	(4.8)	(8.2)	(9.8)	(15.4)	(16.2)	(29.0)

Tab. 16 Exhaust time

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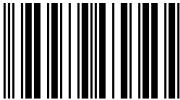
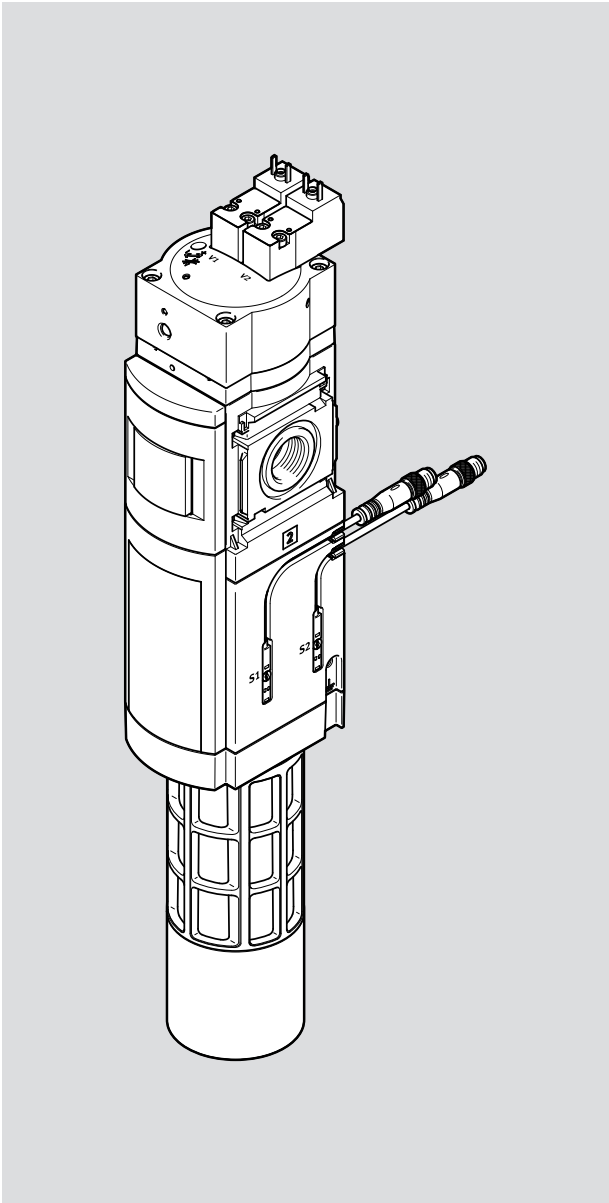
Phone:
+49 711 347-0

Internet:
www.festo.com

MS6-SV-...-D-10V24
Soft-start/quick exhaust valve

FESTO

Operating instructions



8164008

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2022-06c
[8164010]

Translation of the original instructions

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1 About this document

This document describes the use of the soft start/quick exhaust valve.

The document contains additional information for use of the product in safety-related systems (safety handbook in accordance with IEC 61508).

1.1 Applicable documents



All available documents for the product → www.festo.com/sp.

1.2 Target group

The document is targeted towards individuals who mount and operate the product. It is additionally targeted towards individuals who are entrusted with the planning and application of the product in a safety-oriented system.

1.3 Specified standards

Version	
EN ISO 4414:2010-11	EN ISO 13849-2:2012-10
EN ISO 13849-1:2015-12	EN ISO 14118:2018-02

Tab. 1: Standards specified in the document

2 Safety

2.1 Safety instructions

- Only use the product in its original condition without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Observe the identifications on the product.
- Take into account the ambient conditions at the location of use.
- Before working on the product, switch off the power supply and secure it against being switched on again.
- Observe the tightening torques. Unless otherwise specified, the tolerance is $\pm 20\%$.
- Only use compressed air as an operating medium in accordance with the specification → 12 Technical data.

2.2 Intended use

The product is intended solely for fast and safe venting and for slow pressurisation of pneumatic piping systems and terminals in industry.

The product is intended for installation in machines or automation systems and must be used exclusively as follows:

- in an industrial environment
- within the limits of the product defined by the technical data → 12 Technical data.
- in its original condition, without unauthorised modifications
- in perfect technical condition
- in standard operation, which includes standstill, set-up and service operation, as well as emergency operation

2.3 Foreseeable misuse

The following are examples of foreseeable misuse and are not approved as intended use:

- outdoor operation
- use as a press safety valve
- bypass of safety function
- use in reversible operation with reversal of supply air and exhaust air
- vacuum operation

2.4 Training of qualified personnel

Work on the product may only be carried out by qualified personnel who can evaluate the work and detect dangers. The qualified personnel have skills and experience in dealing with electropneumatic (open-loop) control technology.

3 Additional information

- Contact the regional Festo contact if you have technical problems → www.festo.com.
- Accessories and spare parts → www.festo.com/catalogue.

4 Product overview

4.1 Product design

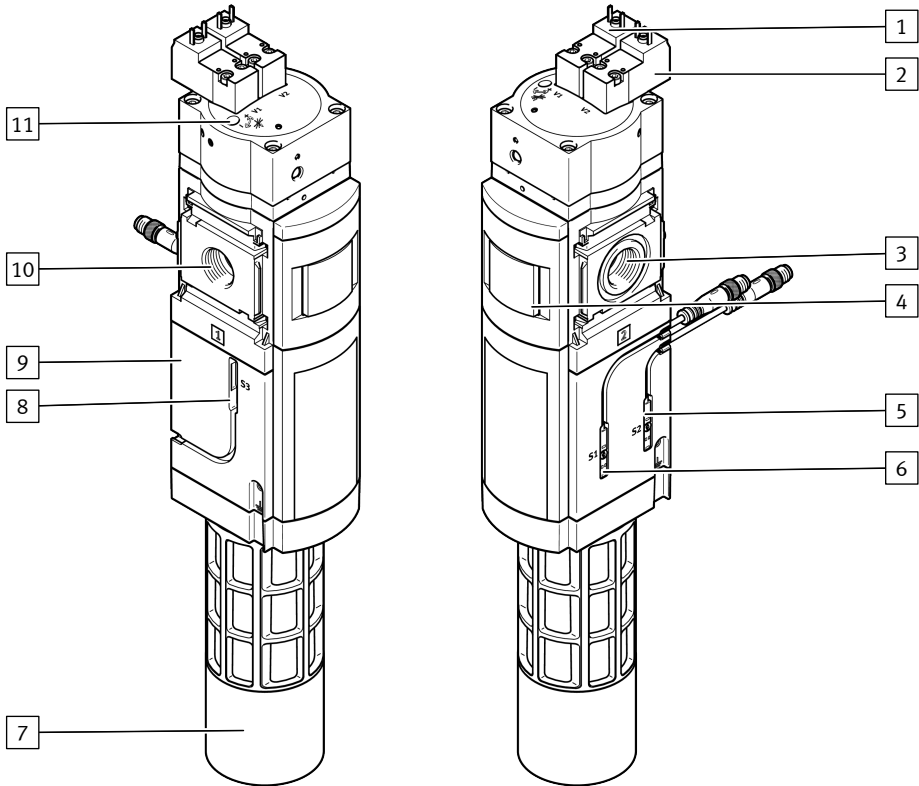


Fig. 1: Operating elements and connections

- | | | | |
|---|---------------------------------------|----|--|
| 1 | Coil connection pilot valve V1 | 7 | Silencer mounted at pneumatic port 3 |
| 2 | Coil connection pilot valve V2 | 8 | Slot for proximity switch S3 |
| 3 | Pneumatic port 2 (output pressure p2) | 9 | Valve body |
| 4 | Pressure indicator (optional) | 10 | Pneumatic port 1 (operating pressure p1) |
| 5 | Proximity switch S2 | 11 | Flow control screw for soft-start function |
| 6 | Proximity switch S1 | | |

4.2 Function

The product changes from the normal position to the switching position when both coils are energised simultaneously. The normal position is achieved by switching off both coils.

The product has two safety functions:

- Pressure release
- Protection from unexpected start-up (non-switching)

The product has queries from proximity switches, which are intended for diagnostics of the internal valves. Performance level d/e in category 3 can be achieved by using proximity switches S1 and S2. Performance level e in category 4 can be achieved by using an additional proximity switch S3.

Circuit symbol	Function
	<p>Soft-start/quick exhaust valve, electrically actuated.</p>

Tab. 2: Circuit symbol for the function

Designations

Port	Identifier	Functional principle	Position
Port 1 (operating pressure p1)	1	Pneumatic	→ 4.1 Product design.
Port 2 (output pressure p2)	2		
Port 3 (exhaust p3)	3		
Coil connection pilot valve V1	V1	Electric	
Coil connection pilot valve V2	V2		
Proximity switch S1	S1	Magnetic	
Proximity switch S2	S2		
Proximity switch S3 ¹⁾	S3		
Flow control valve	DR	Mechanical system	

1) Optional.

Tab. 3: Interfaces

Switching logic

In the normal position (completely exhausted product), the pilot valves V1 and V2 are not actuated. If both pilot valves are actuated, the product switches first to the switching position 1 and then, when the switch-through pressure is reached, automatically into switching position 2 → Fig. 2.

V1	V2	S1	S2	S3	MS6-SV-...-D
Voltage [V]		Switching position			Status
0	0	1	1	1	Normal position Port 1 blocked, passage from port 2 to 3 opened.
24	0	0	1	1	Normal position, optional testing condition → Tab. 6 Recommendation for actuation and diagnostics. Port 1 blocked, passage from port 2 to 3 opened.
0	24	1	0	1	Normal position, optional testing condition → Tab. 6 Recommendation for actuation and diagnostics. Reduced flow rate via flow control valve from port 1 to 2, passage from port 2 to 3 opened.
24	24	0	0	1	Switching position 1. Reduced flow rate over flow control valve from port 1 to 2, passage from port 2 to 3 blocked.
24	24	0	0	0	Switching position 2. Full flow rate from port 1 to 2, passage from port 2 to 3 closed.

Tab. 4: Switching logic

Switching characteristics

Switching behaviour of the product's internal valves. The normally exhausted position is sensed by the proximity switch. Switching logic → Tab. 4 Switching logic.

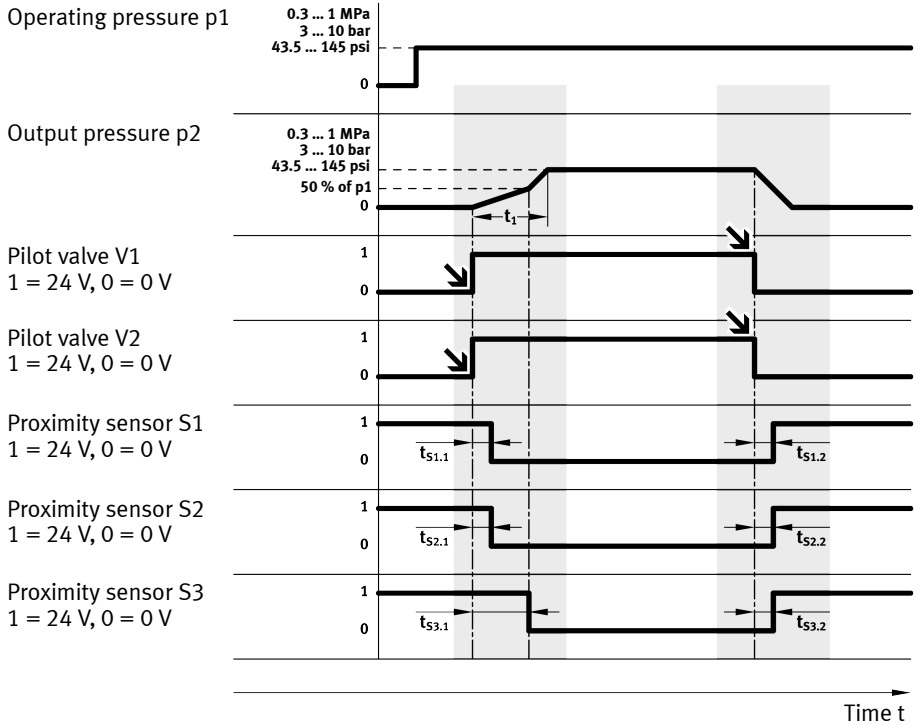


Fig. 2: Input and output switching behaviour in normal status

Proximity switch reaction times ¹⁾			
Switching on		Switching off	
t_1	Depending on p1, flow control valve setting and system volume at p2.		
$t_{s1.1}$	Maximum of 4 s after signal at V1.	$t_{s1.2}$	Maximum of 4 s after signal drop at V1.
$t_{s2.1}$	Maximum of 4 s after signal at V2.	$t_{s2.2}$	Maximum of 4 s after signal drop at V2.
$t_{s3.1}$	After signal at V1 and V2. Depending on p1, flow control valve setting and system volume at p2.	$t_{s3.2}$	Maximum of 5 s after signal drop at V1 and V2. Depending on system volume at p2.

1) After the reaction time, the signals are applied statically. The maximum specified reaction times must be considered in the diagnostics. These reaction times are normally shorter.

Tab. 5: Proximity switch reaction times

Switch-through pressure

There is a flow control screw in the cover of the product. The flow control screw can be used to generate a gradual pressure build-up of output pressure p2 → 12.5 Filling flow.

The flow rate and thus the pressure rise can be adjusted by turning the flow control screw. When output pressure p_2 reaches about 50% of operating pressure p_1 , the maximum flow rate performance is enabled.

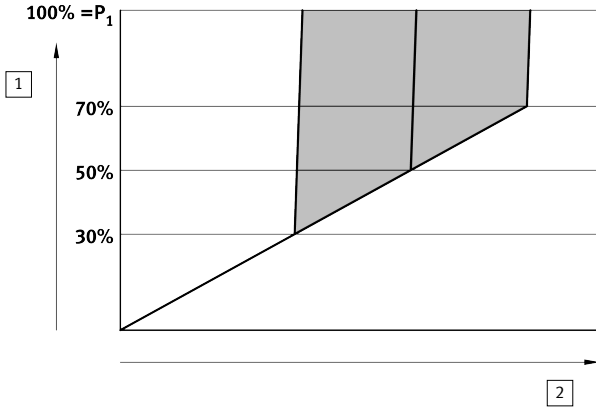


Fig. 3: Switch-through pressure tolerance field

1 Ratio of p_2 to p_1 [%]

2 Filling time t

Actuation and diagnostics

If the results of actuation and the sensor signals S_1 , S_2 and S_3 are not plausible, carry out the following measures:

1. Switch off voltage to pilot valves V_1 and V_2 .
2. Output error message.
3. Prevent new switching.

Sequence	Activity	Status and status transitions
Diagnostics at each switching operation		
1.	Apply voltage to pilot valves V_1 and V_2 .	$V_1 = 1; V_2 = 1$
2.	Record edge change at proximity switches S_1 and S_2 .	$S_1 = 1 \rightarrow 0; S_2 = 1 \rightarrow 0$
Optional, when using a third proximity switch S_3		
3.	Record edge change at proximity switch S_3 .	$S_3 = 1 \rightarrow 0$
Corresponding reaction times \rightarrow Fig. 2.		

Sequence	Activity	Status and status transitions
Diagnostics at every reset to the normal position		
1.	Switch off voltage to pilot valves V1 and V2.	V1 = 0; V2 = 0
2.	Record edge change at proximity switches S1 and S2.	S1 = 0 → 1; S2 = 0 → 1
Optional, when using a third proximity switch S3		
3.	Record edge change at proximity switch S3.	S3 = 0 → 1
Corresponding reaction times → Fig. 2.		
Diagnostics in normal position		
Pay attention to forced switch on/off → 12.1 Safety data.		
1.	Apply voltage to pilot valve V1.	V1 = 1
2.	Record edge change at proximity switch S1.	S1 = 1 → 0
3.	Switch off voltage to pilot valve V1.	V1 = 0
4.	Record edge change at proximity switch S1.	S1 = 0 → 1
5.	Apply voltage to pilot valve V2.	V2 = 1
6.	Record edge change at proximity switch S2.	S2 = 1 → 0
7.	Switch off voltage to pilot valve V2.	V2 = 0
8.	Record edge change at proximity switch S2.	S2 = 0 → 1
Corresponding reaction times → Fig. 2.		

Tab. 6: Recommendation for actuation and diagnostics

4.3 Information on functional safety

4.3.1 Safety function in accordance with EN ISO 13849

The product achieves a performance level for the following safety functions:

- safe venting
- Protection against unexpected start-up (pressurisation) after EN ISO 14118

NOTICE

Loss of the safety function

Common cause failures (CCF) cause the failure of the safety function, since in this case both channels in a two-channel system fail simultaneously.

If measures to control the CCFs are not observed, the safety function of the soft-start/quick exhaust valve can be impaired.

- Make sure that the described measures are observed → Failures due to a common cause (Common Cause Failure – CCF).
→ 12.1 Safety data

NOTICE

Loss of the safety function

Non-compliance with the technical data can lead to loss of the safety function.

- Observe the technical data → 12 Technical data.

Failures due to a common cause (Common Cause Failure – CCF)

To achieve the desired performance level, the applicable measures against CCF must be implemented in accordance with the specifications of EN ISO 13849-2.

PFH_d value



The PFH_d value depends on the model of the product and the annual actuation rate (n_{op}).

PFH_d value MS6-SV-...-D

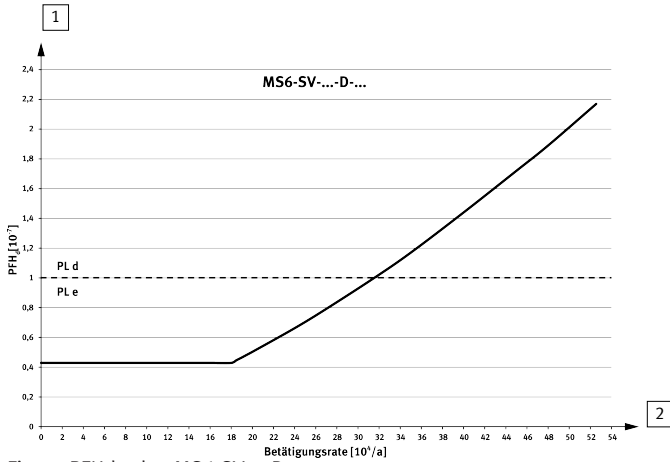


Fig. 4: PFH_d value MS6-SV-...-D

1 PFH_d [10⁻⁷]

2 Actuation rate (nop) [10⁴/a]

PFH_d value MS6-SV-...-D-S3

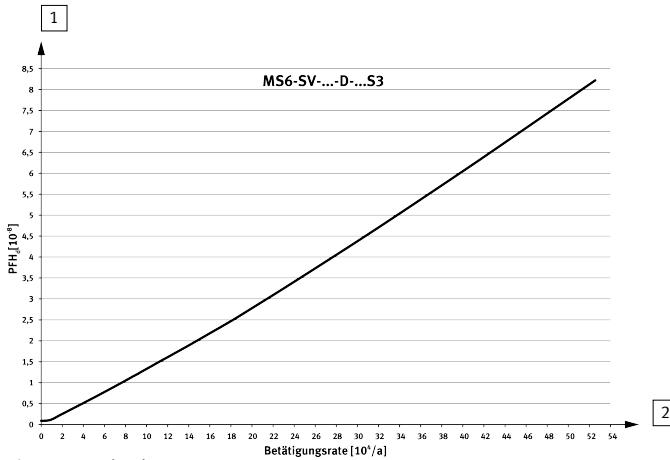


Fig. 5: PFH_d value MS6-SV-...-D-S3

1 PFH_d [10⁻⁸]

2 Actuation rate (nop) [10⁴/a]

5 Assembly

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Information about mounting the module connector, connecting plate and mounting bracket can be found in the instruction manual enclosed with the relevant accessories.

5.1 Mounting clearances

NOTICE

Loss of the safety function

Failure to comply with the minimum distance of 15 mm between the silencer and base can result in the loss of the safety function.

- Observe the minimum distance of 15 mm below the silencer → Fig. 6.
The free space ensures the exhaust can escape.

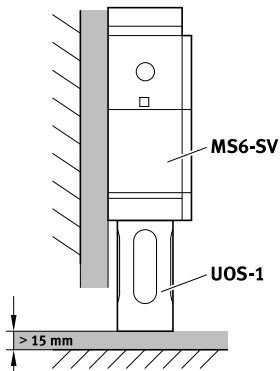


Fig. 6: Mounting

5.2 Preparation

- Observe the flow direction from port 1 to port 2. Numbers **1** and **2** on the housing → Fig. 7 are provided for orientation.

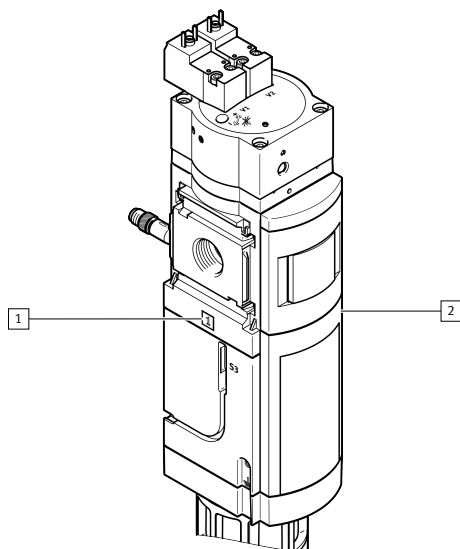


Fig. 7: Flow direction

5.3 Assembly with MS-series service unit components

⚠ WARNING

Loss of the safety function

If devices that impair the exhaust are placed behind the pneumatic connection 2 of the soft start/quick exhaust valve, this can result in loss of the safety function.

- Only place devices that do not impair the exhaust downstream of pneumatic connection 2.

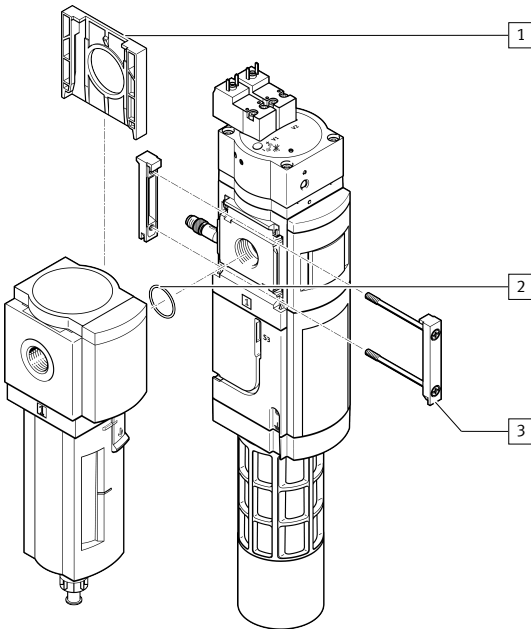


Fig. 8: Assembly

1. Slide the cover cap MS6-END **1** upwards and remove it.
2. Insert a seal **2** between the separate devices (module connector in scope of delivery).
3. Place the module connector **2** in the slots of the separate devices.
4. Fasten the module connector with two screws (module connector in scope of delivery).
Tightening torque: maximum 1.2 Nm

6 Installation

6.1 Safety

⚠ WARNING

Risk of injury from compressed air.

- Before carrying out installation and maintenance work, switch off the compressed air supply.

6.2 Pneumatic installation

Port 1 and 2

If using screw connectors:

1. Note the screw-in depth of the connector thread: 10 mm.
2. Make sure that the compressed air lines are connected correctly.
3. Screw the fittings into the pneumatic ports using a suitable sealing material.

Port 3



Exhausting a system using the product results in high noise levels.

- Recommendation: use silencer → www.festo.com/catalogue.

1. Screw the silencer into pneumatic port 3.
2. Make sure that the exhaust is unrestricted. Neither the silencer nor port 3 may be blocked.

6.3 Electrical installation

⚠ WARNING

Risk of injury due to electric shock.

- For the electrical power supply with extra-low voltages, use only PELV circuits that guarantee a reinforced isolation from the mains network.
- Observe IEC 60204-1/EN 60204-1.

Connecting the product

- Connect pilot valves and proximity switches.

Example of circuits

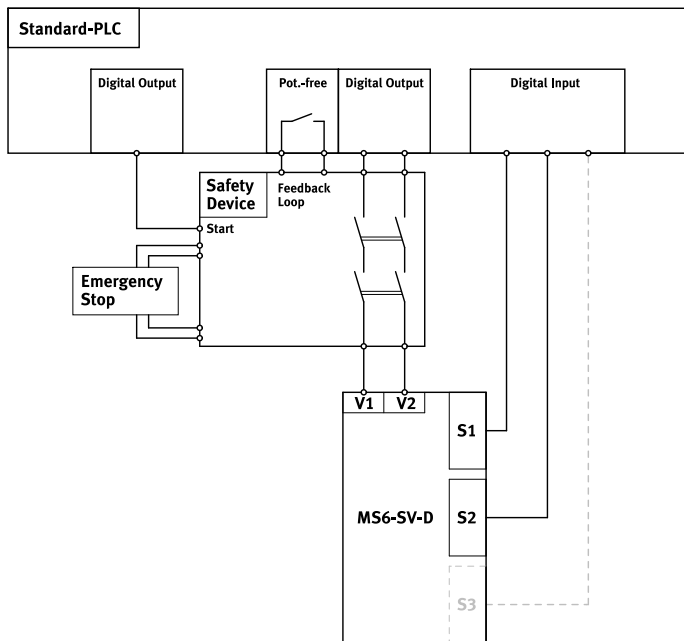


Fig. 9: Example of circuits

Designations	
S1	Proximity switch S1
S2	Proximity switch S2
S3	Proximity switch S3
V1	Pilot valve 1
V2	Pilot valve 2
Pot.-free	Potential-free contact
Emergency Stop	Emergency stop (input circuit)
Feedback Loop	Feedback circuit
Safety Device	Safety relay unit or safety PLC
Digital Output	Digital output
Digital Input	Digital input
Standard PLC	Programmable logic controller

Tab. 7: Designations in circuit examples

7 Commissioning

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The product does not have its own control logic and must therefore be integrated into the control system through appropriate measures.

Graphic representation of the switching behaviour → Fig. 2.

Proceed as follows to commission the product:

- Apply operating pressure p1.
 - ↳ The product is now ready for operation and can be actuated.
The filling speed of the pneumatic system can be adjusted with the flow control valve → Fig. 1.

8 Operation

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Perform a forced switch-off at least once a month if the process-related switching frequency is lower.

9 Maintenance

9.1 Maintenance work

A dirty silencer can extend the time needed for exhausting the system and thus restrict the safety function.

- Check the silencer regularly and replace if necessary.

9.2 Cleaning

1. Switch off energy sources:
 - Operating voltage
 - Compressed air
2. If necessary, clean the product on the outside. Soap suds (max. +50 °C), petroleum ether and all non-abrasive cleaning agents may be used.

10 Malfunctions

10.1 Fault clearance

- Check compressed air supply
- Check power supply
- Check installation of the signal lines
- Start device → 7 Commissioning.
- Implement possible remedies → Tab. 8 Fault clearance.
- If the fault occurs again: contact Festo service → www.festo.com.

Malfunction	Possible cause	Remedy
Product does not switch	Power supply is insufficient	- provide sufficient power supply.
	Pressure supply interrupted	- Restore compressed air supply.
	Malfunction due to electrical or electromagnetic effects (EMC measures not in compliance).	- note maximum length of the signal lines. - Run the control and power lines separately. - use screened cables. - Provide low-impedance paths to earth.
Pressure p1 collapses briefly at every switching operation	The cross-section of the MS6-SV-...-D pressure supply is too small.	- Tighten flow control screw a little. - Attach reservoir in front of input p1. - Modify the compressed air supply, e.g. increase cross-section of the power supply cable.

Tab. 8: Fault clearance

11 Dismantling

1. Switch off the energy sources
 - Operating voltage
 - Compressed air
2. Disconnect the applicable connections from the product.

12 Technical data

12.1 Safety data

Safety characteristics	MS6-SV-...-D
Safety function	Safe venting and protection against unexpected pressurisation
Service-life value B ₁₀	0.9 mill. switching cycles
Service life [years]	20
Achievable performance level (PL) in accordance with EN ISO 13849-1	
With sensing of S1 and S2	Category 3, PL d or category 3, PL e ¹⁾
With sensing of S1, S2 and S3	Category 4, PL e
Probability of dangerous failure per hour	
PFH _d value MS6-SV-...-D	→ Fig. 4.
PFH _d value MS6-SV-...-D-S3	→ Fig. 5.
CCF measures	Relevant requirements EN ISO 13849-2 → Failures due to a common cause (Common Cause Failure – CCF).
Note on forced checking procedure	Switching frequency min. 1/month

1) Depending on the average number of actuations per year (nop).

Tab. 9: Safety data

MS6-SV-...-D	
Certificates, declaration of conformity	→ www.festo.com/sp

Tab. 10: Product conformity

12.2 Technical data, mechanical

MS6-SV-...-D	
Type of mounting	In-line installation With accessories
Design	Piston seat has no underlap
Position sensing principle	Piston magnet principle
Reset method	Mechanical spring
Mounting position	Any
Sound pressure level [dB(A)]	75 with silencer UOS-1
Environmental conditions	
Shock resistance	Shock test with severity level 2 in accordance with FN 942017-5 and EN 60068-2-27
Vibration resistance	Transport application test with severity level 2 in accordance with FN 942017-4 and EN 60068-2-6
Degree of protection	
Degree of protection	IP65 (fully mounted and connected)
Protection class	III
Materials	
Housing	Die-cast aluminium
Seal	NBR

Tab. 11: Technical data, mechanical

Type of severity level (SL)					
Vibration load					
Frequency range [Hz]		Acceleration [m/s ²]		Deflection [mm]	
SL1	SL2	SL1	SG2	SL1	SL2
2 ... 8	2 ... 8	–	–	±3.5	±3.5
8 ... 27	8 ... 27	10	10	–	–
27 ... 58	27 ... 60	–	–	±0.15	±0.35
58 ... 160	60 ... 160	20	50	–	–
160 ... 200	160 ... 200	10	10	–	–
Shock load					
Acceleration [m/s ²]		Duration [ms]		Shocks per direction	
SL1	SL2	SL1	SL2	SL1	SL2
±150	±300	11	11	5	5

Type of severity level (SL)		
Continuous shock load		
Acceleration [m/s ²]	Duration [ms]	Shocks per direction
±150	6	1000

Tab. 12: Type of severity level (SL)

12.3 Technical data, pneumatic

MS6-SV-...-D		
Pneumatic port 1, 2	G 1/2	
Pneumatic port 3	G 1	
Pilot air supply	Internal	
Exhaust function	Cannot be throttled	
Manual override	None	
Type of control	Pilot-controlled	
Valve function	3/2-way valve, single solenoid, closed Soft-start function	
Medium		
Operating medium	Compressed air to ISO 8573-1:2010 [7:4:4] and inert gases	
Note	Lubricated operation possible, in which case lubricated operation will always be required	
Temperature		
Medium	[°C]	-10 ... +50
Environment	[°C]	-10 ... +50
Bearing	[°C]	-10 ... +50
Operating pressure		
Operating pressure	[MPa]	0.35 ... 1
	[bar]	3.5 ... 10
	[psi]	50.75 ... 145
Residual pressure in normal operation	[MPa] [bar] [psi]	0 (no residual pressure)
Residual pressure in the event of error	[MPa]	≤ 0.04; at p ₁ = 1 MPa and flow control valve fully open
	[bar]	≤ 0.4; at p ₁ = 10 bar and flow control valve fully open

Technical data

MS6-SV-...-D		
	[psi]	≤ 5.8; at p1 = 145 psi and flow control valve fully open
Characteristic flow rate values		
Standard nominal flow rate 1 → 2	[l/min]	4300; at p1 = 0.6 MPa and p2 = 5 bar (at p1 = 6 bar and p2 = 5 bar, at p1 = 87 psi and p2 = 72.5 psi)
Standard flow rate 2 → 3	[l/min]	9000; at p1 = 0.6 MPa (p1 = 6 bar, p1 = 87 psi)
Standard flow rate 2 → 3 in the event of a critical fault	[l/min]	≥ 6000; at p1 = 0.6 MPa (at p1 = 6 bar, at p1 = 87 psi)
Switch-through point		Approx. 50% of p1
Filling flow		Adjustable by flow control valve
minimum pause time after exhaust	[s]	≥ 1

Tab. 13: Technical data, pneumatic

12.4 Technical data, electrical

MS6-SV-...-D	
Actuation type	Electric
Protection against electric shock (protection against direct and indirect contact to EN/IEC 60204-1)	By PELV fixed power supply
Pilot valves	
Nominal operating voltage [V] DC	24
permissible voltage fluctuations [%]	±10
Duty cycle [%]	100
Nominal power per solenoid coil [W]	1.8 (at 24 V DC)
Proximity switch SMT-8M-A-PS-24V-E	
Nominal operating voltage [V]	24
permissible voltage fluctuations [%]	±10
Switching element function	N/O contact
Measurement principle	Magneto-resistive
Switching status display	LED
Switching output	PNP

Tab. 14: Technical data, electrical

12.5 Filling flow

Throttle flow rate q_n , as a function of the number of revolutions n of the flow control screw

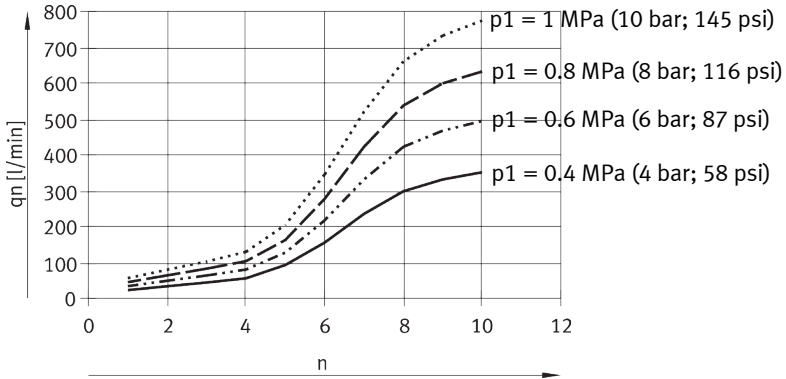


Fig. 10: Flow diagram

12.6 Exhaust time

The following table shows the exhaust time in normal operation (N) and in the event of a fault (F) for different volumes and operating pressures.

NOTICE

In the case of a fault (F) the worst possible fault in the valve's interior is assumed (worst case).

Normal operation (N) Fault F			Exhaust time [s]					
Operating pressure	[MPa]		0.35		0.6		1	
	[bar]		3.5		6		10	
	[psi]		50.75		87		145	
Exhaust to	[MPa]		0.1	0.05	0.1	0.05	0.1	0.05
	[bar]		1.0	0.5	1.0	0.5	1.0	0.5
	[psi]		14.5	7.25	14.5	7.25	14.5	7.25
Volume [l]	2	N	0.1	0.2	0.24	0.3	0.3	0.4
		(F)	(0.16)	(0.22)	(0.28)	(0.35)	(0.36)	(0.52)
	10	N	0.3	0.45	0.55	0.7	0.7	0.9
		(F)	(0.4)	(0.6)	(0.8)	(1.1)	(1.2)	(1.9)
	20	N	0.5	0.85	1.0	1.3	1.4	1.7
		(F)	(0.8)	(1.25)	(1.5)	(2.2)	(2.4)	(3.9)
	40	N	1.2	1.9	2.2	3.0	3.0	3.9
		(F)	(1.7)	(2.8)	(3.4)	(5.3)	(5.1)	(8.1)
	150	N	3.2	5.0	6.0	8.2	11.0	12.8
		(F)	(4.8)	(8.2)	(9.8)	(15.4)	(16.2)	(29.0)

Tab. 15: Exhaust time

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